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E L E M E N T S
O F
C O N C H O L O G Y :
O R,
A N I N T R O D U C T I O N
T O

The KNOWLEDGE of SHELLS.

By EMANUEL MENDES DA COSTA,
Member of the Academia Cæsar. Imper. Nat. Curios. Plinius IV.
And of the BOTANIC SOCIETY of FLORENCE.

WITH SEVEN PLATES,
Containing Figures of every Genus of Shells.

Concharum genera, in quibus mira ludentis naturæ varietas, tot
colorum differentiæ, tot figuræ.

PLINII HIST. NATUR. LIB. IX. CAP. XXXIII.

L O N D O N,
Printed for BENJAMIN WHITE,
at Horace's Head, in Fleet-Street.

MDCCLXXVI.

1776

MOTTEK DI ET

MEXICAN AMERICAN WAR

CHRONICLE OF THE

WAR
BETWEEN
THE
UNITED STATES
AND
MEXICO

FROM
1846
TO
1848
BY
J. M. SMITH

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P R E F A C E.

AS I never professed myself a Conchologist, I think it incumbent on me to give some account of the cause for attempting the elements of the study.

The bent of my researches is the fossil kingdom. In pursuing that science, the part of it *emphatically* called the *extraneous fossils*, as substances not the real productions of the earth, but incontestably the *exuviae* or *remains* of animals and vegetables, I found should be methodized only by the systems of Zoology and Botany.

The most numerous remains of animals found fossil, are of the Testaceous order. They are not only very frequent, but generally near entire or perfect: whereas the fossil remains of other animals, as also vegetables, are mostly found in detached parts or fragments.

I was therefore induced to dedicate an attention to the study of this particular branch of Zoology; which produced a work, at first formed into a course of public lectures on Conchology: but, not meeting with the desired encouragement, I have now modelled it into the present treatise.

In regard to the merit of it, in the deviations from other systems, I entirely submit to the candid judgement of the learned in this branch of natural history, either to confirm or reject.

One subject however I shall insist upon; that is, to explode the Linnæan obscenity in his characters of the Bivalves; not only for their licentiousness, but also that they are in no ways the parts expressed. Science should be chaste and delicate. Ribaldry at times has been passed for wit; but Linnæus alone passes it for terms of science. His merit in this part of natural history is, in my opinion, much debased thereby; and I
can

P R E F A C E.

v

can compare these his terms only to *Spintria* *, in a valuable collection of Roman coins.

I therefore with due submission recommend to that otherways great naturalist, to change them, and expunge this reproachable obscenity † from his works.

In the printing off the sheets, some very essential errors have inadvertently escaped me. These errors, as essential ones, and relative to my method, I beg leave to note here, rather than in a common table of *errata*; that they may appear more conspicuous, or open to the correction of the candid reader: however, I must observe that they remain only in the text, as the *Tabulæ Synopticæ* are right.

* Very obscene coins struck by the Emperor Tiberius in his retreat with his favourite Sejanus to the island of Caprea; not regarded by Medalists, on account of their obscenity.

† One instance will more than suffice, and let it be his *Venus Dione*, Syft. Nat. XII. p. 1128, N^o 112; a description, fit only for the perusal of a profligate Aretin, or Rochester.

Page

Page 154, third paragraph, *r.* This second part, which is the fifth family, contains six Genera, one Genus whereof, viz. the Orthoceratites, is of a simple figure; four Genera, as the Lituitæ or Croziers, Turbines Polythalami, Ammonia and Ammonoïdæ, are all turbinated; and the other Genus, or Nautilus, is revolved.

P. 173, third paragraph, *r.* This third part, which is the sixth family, contains three Genera; to wit, 1. Nuces seu Bullæ, the Pewits eggs or Dippers; 2. Semiporcellanæ; and, 3. Cyprææ five Porcellanæ, the Cowries.

The first Genus is the Nuces seu Bullæ, &c.

P. 174, l. 2, 12, and 14, and p. 175, last line, for family and families, *r.* Genus and Genera.

P. 176, l. 1, 7, and 14, for families and family, *r.* Genera and Genus.

P. 177, l. 1, family, *r.* Genus; and l. 6, for eighth family, *r.* third Genus.

P. 178, l. 1, and 4, family, read Genus.

P. 182, l. 2, ninth family, *r.* seventh family,

P. 187, l. 1, tenth family, *r.* eighth family.

P. 189, l. 3, eleventh family, *r.* ninth family.

P. 191, l. 10, twelfth family, *r.* tenth family,

P. 193, l. 19, thirteenth family, *r.* eleventh family.

P. 195, l. 19, fourteenth family, *r.* twelfth family.

P. 197, l. 6, fifteenth family, *r.* thirteenth family.

P. 198, l. 12, sixteenth family, *r.* fourteenth family.

P. 207, l. 11, seventeenth family, *r.* fifteenth family.

All which errors the reader will perceive originate from the primary one, p. 173.

Another

Another very capital error, which is typographical, occurs, p. 128, l. 8, viz. "these animals are absolutely loose from their shells;" whereas it should be, "these animals are *not* absolutely loose from their shells."

P. 135, in the list of Univalves, after *Aures Marinæ*, add *Vermiculi* and *Dentalia*; and after *Cochleæ*, dele *Turbines*.

I repeat my submission to the candid judgement of the learned; and shall conclude my preface with the motto used by the celebrated Dr. Lister, in some of his ornamental plates to the first edition of his *Historia Conchyliorum*:

Joculare tibi videtur;

et sanè benè:

dum nihil habemus majus,

Calamo ludimus.

EMANUEL MENDES DA COSTA.

London, 4th September, 1776.



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CON.

CONCHOLOGY.

SECTION I.

THE study of Shells, or testaceous animals, is a branch of Natural History, though not greatly useful in human œconomy, yet perhaps, by the infinite beauties of the subjects it treats of, is adapted to recreate the senses, and insensibly to lead the amazed admirer into the contemplation of the glory of the Divinity, in their creation.

Shells seem to form a part of the Creation, not so immediate to the use of
B mankind;

2 CONCHOLOGY.

mankind; they rather appear to be a link of that wise and provident chain of nature, by which each part is connected with the whole, and the seeming voids or breaks between the ranks of animals is with infinite wisdom filled up.

This peculiar branch of the History of Nature, I shall call Conchology^a. It comprehends the study of all animals that are testaceous, or have shell coverings; not only those of the Sea, but also those of the Rivers and Land.

The definition of a Shell I make as follows. A kind of stone-like calcareous covering or habitation, in which the whole animal, otherwise quite naked or fleshy, (for each part or limb is not particularly covered with this stoney crust,) lives included as in a house: whereas the crustaceous animals, as lobsters, crabs, &c. (whose crust can bear no other definition

^a Many authors call it *Conchyliology*.

SECTION I. 3

than this given for Shells,) are not naked, but have every particular limb or part separately covered with the crust, which consequently is formed into many joints, insomuch that the whole animal seems as it were loricated, or in a coat of mail^b.

All Testaceous animals are formed of two distinct parts: the one, which is the animal, is soft or fleshy; the other, which is the Shell or habitation, is hard, of a stoney consistence, and covers the animal; to which it is connected or attached by muscles.

All Shell animals are exanguious, that is, have no blood similar to that of qua-

^b Some Authors have strove to give definitions of a Testaceous and a Crustaceous animal, but in vain, or without any fixed or solid characters. See Klein, Nat. Disp. Echinodermatum, Sect. 1. Shells and crusts of fish have the same nature and qualities, and therefore, I think, no other definition can be made.

4 CONCHOLOGY.

drupeds, birds, fishes, or reptiles; and therefore properly appertain to the fifth class of animals, or insects. They are also destitute of any bones; those fulcra or props to the muscles of the animal structure, being exterior in these creatures, in their Shells; and not interior, as all bones of other animals are placed. However, they are endowed with the principal parts, as the mouth, lungs, heart, &c. besides other parts suitable to their nature of life. The full descriptions of the animals themselves, or any anatomical disquisitions, are not the scope of my present work. It is rather too abstruse and unentertaining: but for those curious particulars I shall refer my readers to the principal authors who have investigated them scientifically; especially Lister^c,
Adanson

^c The Oyster, common Land Snail, &c. in his *Historia Conchyliorum—Exercitatio Anatomica*, in quâ de Cochleis maxime terrestribus et Limacibus agitur. Lond. 1694, 8vo. *Exerc. Anat. altera*, in quâ maxime agitur de Buccinis Fluvialibus et
Marinis.

SECTION I. 5

Adanson in his History of the Senegal Shells; and Argenville, in his Zoömorphose, added to the second edition of his Conchyliologie.

Besides the above, we meet with many descriptions of Shell fish dispersed in the works of the curious; such as Columna's account of the *Purpura*^d; Rumphius, of the animals of the chambered and paper Nautili; Reaumur of *Solenes*^e and *Pholades*; Sellius of the *Teredo* or Ship-worm^f; and several others^g; and lastly, the

Marinis. Lond. 1695, 8vo. et Exerc. Anat. tertia. Conchyliorum Bivalvium utriusque Aquæ. Lond. 1692, 4to. all with figures.

^d Fabii Columnæ Lyncei *Purpura*, seu de *Purpura* ab animali testaceo fusa, aliisque rarioribus testaceis quibusdam. Romæ, 1616, cum fig. 4to.

^e In the Memoirs of the Royal Academy of Sciences at Paris.

^f Godofredi Sellii *Historia Naturalis Teredinis* seu *Xylophagi Marini*. Trajecti ad Rhenum, 1733, 4^{to}. fig.

^g Joh. Jacobi Harderi M. D. Basil. &c. *Examen Anatomicum Cochleæ terrestres domiportæ*. Basil. 1679, 12^{mo}. fig.

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the justly celebrated Linnæus, who places at the head of the definition of each genus of Shell the genus of animal, which, according to his system, inhabits them: however, all these descriptions of the animals have never yet been collected together, and methodically digested.

This naturally leads me to the discussion of a subject of great debate among Naturalists, which is, whether the methodical system or arrangement of testaceous Animals should be formed from the Animals themselves, or from their habitations or Shells. The former method seems most scientific; but the latter, from the Shells, is universally followed, for many reasons.

Ant. de Heyde M. D. Amst. Anatome Mytuli. Amstelod. 1684, 12^m. fig.

Rouffet, Observations sur les Vers de Mer qui percent les Vaisseaux, &c. La Haye, 1733, 8vo. fig.

Swammerdam, Biblia Naturæ, Leydæ, folio. 2 vols. fig.

The

SECTION I. 7

The vast number of species hitherto discovered, and the numerous collections made, exhibit only the shells or habitations, the Animals themselves being scarcely known or described. Of the shells we daily discover, few are fished up living; the greater number are found on shores, dead and empty. Accurate descriptions of Animals, whose parts are not easily seen or obvious, and anatomical researches, are not in the capacity of every one to make; nor are the particular parts and their respective functions so easily cognizable to any, but expert, assiduous, and philosophical enquirers. How is it possible then to arrange a numerous set of Animals by characters or parts, we can with difficulty, if ever, get acquainted with, in the far greater number of the species we collect or discover?

The indefatigable and accurate Fabius Columna was surprized at the omission; he even complains of it. It is astonishing,

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says he, that of all the writers on this subject, not one has considered the Animals that inhabit the shells, or given figures of them. He owns, however, that many are seldom seen by us, and that the researches on their manner of life are extremely difficult. The great difficulty of these researches should have been his answer: and it must always remain so; for of the great number of species discovered since his time, (an æra in which natural history has flourished more than at any other period) we scarcely know the inhabitant Animals of some scores; and even those are very few of distant regions, but chiefly of the coasts of Europe, countries in which assiduous and expert naturalists have resided.

The most easy and obvious characters are certainly the best on which to found all systems of natural history. I have treated this point fully in my lectures on fossils. Scientific researches in regard
to

to the arrangement of Animals are to be held in the same light, as chemical ones in regard to fossils: they are the extreme disquisitions to ascertain the species, when the more obvious and easy characters are vague or wanting.

Thus all ranks of animals are arranged into systems by obvious and external, not by scientific characters; even the animals of bulk, and that are our constant companions. Quadrupeds are methodized by their teeth, horns, hoofs, and hides or coverings; birds, by their plumage, beaks, and claws; reptiles and insects, by like particulars; the very fishes, though of a different element, undergo arrangements by their fins; and the vegetables are distinguished by their flowers and fruits. All these arrangements are on the principles of external and obvious characters. Why then is it required to arrange by scientific or difficult characters a set of animals who chiefly live in the depths of the sea, have hardly
a pro-

a progressive motion, and are for the greater part difficultly, if ever, in our reach? I repeat, why should naturalists demand of such animals only, a system, or arrangement, the most difficult to attain? while all the other orders of animals, whose arrangements by such methods are more easily attainable, are methodized only, and with universal consent, by the obvious characters, of teeth, plumage, and fins: characters that cannot be held in any other light, than as analogous to the external characters, or the Shells of testaceous animals?

I am well aware of the arguments alleged against it, *viz.* that, as long as we study only the very Shells, those empty habitations, those spoils or remains only of the animals, the present sole objects of our researches and collections, we consider these beings but partially, or with a side view. There is more to be required. The animals that inhabit them should certainly
guide

SECTION I. 11

guide us in our methodical arrangements; they alone are the principal parts, the very fabricators of the habitations, and give them their forms, bulk, hardness, colours, and all the other particulars of elegance, we admire. If we were to examine attentively these new or almost unknown beings, we shall discover, in their actions and ways of life, an infinity of admirable curious and interesting particulars, capable of exciting the attention of the most inquisitive and expert naturalists. We shall also discover, in their structure, a number of parts as remarkable for their forms as for their functions: this part of the study, therefore, should be seriously contemplated; and not the superficial part, or the Shells only.

Neither is this superficial arrangement, or by the Shells, exempt from many and great difficulties; for Shells, in their different stages of growth, are of very different colours and forms. It is therefore
indis-

indispensably necessary to define and know the animal itself, to fix the species. This objection, however, I do not consider as a solid one; since the naturalist must know, that different colours and forms or appearances, in the different stages of growth, run equally with testaceous animals, through all the orders of nature. Thus for example: the horned quadrupeds have their horns only at stated growths; the birds, a stated colouring of plumage; some insects, yet more remarkable, crawl one part of their lives on the terrestrial, or cut the watery, before they sport in the airy, element. These are far greater changes than any we know of testaceous animals: and therefore the absolute necessity to scrutinize or define the creature by the different stages of its growth, can never, I think, be demanded for them, more than for any other order of animals.

I shall elucidate this point by the following account: Mr. Adanson, in his *Natural History*

History of Senegal, p. 27, an accurate Author, who would methodize testaceous animals by the Fish and not the Shells, describes the *Libot* or *Black Limpet* found on that coast. In his description, he says, that such a vast variety of differences is to be observed in this species, that it is difficult to meet with two Shells alike; and any person would be led to conclude that they were absolutely distinct species, did not the fish, or animal, prove the contrary, by being the same in all. The Shells differed in colour and form; some were white, others grey, ashen, or black; very flat, or very raised, or copped, the number of furrows unequal, from twenty-five to fifty, and are at times set with small prickles. The jaggings or toothings of the contour also differed widely; some being small, or meerly notches, while others were so flisht, or deep, that they gave the whole Shell the form of a star with five or seven rays.

After

After having made my observations, continues Mr. Adanson, on great quantities of this species, I find that all these varieties proceed not only from their different ages, but also from the difference of places they are found in: however, in all the Shells, whether young or old, I found a constant or fixed character in the eye, or beak, which is always pretty obtuse, and situate at about two thirds of the length of the Shell.

I shall observe, in answer to the above, that the different ages of Shells certainly make them wear different appearances, in colour, shape, work, &c. ; and I am convinced, that some are even so greatly changed from one age to another, that they appear absolutely different species. The want of opportunities to trace the different progressions, growth, or changes these animals of the deep undergo, is a *desideratum* which human powers can never attain; and consequently, we must always
be

be open to some confusion and error in this branch of natural knowledge.

Mr. Adanson observes, with great precision, that the difference of the Shells of this kind was so extremely great, that he should not have hesitated to pronounce them distinct species, had he not found the same animal in them all. Indeed a scrutiny into the different Shells he quotes to be of this one same kind is amazing, for hardly one of them agrees with the others: for, besides this *Libot* or *Black Limpet*^h, he also joins with it the *Thorny Limpet*ⁱ, the *Beauty*^k, and the *Astrolepas Limpets*^l, all as of the very same species; which Shells have not the least resemblance to each other.

^h *Patella nigra*, Anonymous New Conchology, Pl. 1. fig. 8. p. 5. N° 8.

ⁱ *Patella echinata*, Id. Pl. 3. fig. 13. p. 18. N° 13.

^k *Patella pulchra*, Id. Pl. 2. fig. 8. p. 12. N° 8.

^l *Astrolepas*, Id. Pl. 3. fig. 2. p. 14. N° 2.

Observations made by respectable and learned naturalists deserve particular attention. I therefore allow with Mr. Adanson, that the same sort of fish being found in all the above Shells is a very presumptive proof of their being of one same species, though I cannot allow it to be a positive or decisive one. I will allow him, that the whole external appearance of the fish and the particular parts were nearly the same; yet I think even that is not a positive proof. For I imagine, the very same kind of animal inhabits different covers or Shells. As for example, the Snails may be the same kind of fish, and form the genus, yet vary so much in their habitations or Shells, as to form different species of that same genus, from only the differences of the Shells or coverings: for the Shell, or covering, may be held for as great a character of the species, as the very fish. Thus the Volutes called *Admirals*, *Brocades*, *Purple Tips* or *Onyxes*, *Tigers*, &c. though

though such different Shells may be inhabited by the same kind of fish, to wit, a *Limax* or *Snail*. And therefore, though the *Limax* or *Fish* is of the very same kind, and forms or fixes the genus, yet the Shells, always constant, will fix or define the species of that same genus. An analogy to this bears strong through all the Animal kingdom; for species of Quadrupeds are distinguished and defined in their genera, from the different colours of their hides; Birds by their various plumage; and Insects by their different colourings. Therefore, why should not Shells, which wear such strong characters, by the same parity of reason, form species of the same genus? or, in other words, why should not the same fish, or genus, yield many different species, according to the several characteristical differences of its Shells or habitations?

I have allowed that Shells in their different growths vary exceedingly, even

so much in some, as to appear different species. All orders of Animals vary in like manner in their different sexes, as well as in their different stages of life. Thus for example, the Tadpole seems a different species from the Frog; the Caterpillar from the Butterfly; the Flamingo bird when young is quite white, but when of a certain age of a beautiful scarlet; the cornigerous quadrupeds that shed their horns also run through several stages, before their horns are complete. These changes we are acquainted with, because they are always obvious to us, and are wrought on animals that are our companions, and breathe in the same element. It is otherwise with the animals of the deep, the knowledge of which we acquire only by accident; and it is even impossible for us to follow them in their various growths and changes, by the most assiduous observations.

I there-

I therefore hold, that the arrangement of Testaceous animals should be made only from their Shells, as the most obvious and strong characters, and not from the fish: for the especial colours and forms of the Shells do not the less give a distribution or order, and proper characters to go by, than does the mechanism of the very fish themselves. However, I do not by this deny all assistance from the fishes to aid the system; the knowledge of them will undoubtedly be of help, but then they are meer secondary and not primary characters. I do not adhere to this opinion, from the sole difficulty of human powers ever attaining compleat observations on these animals of the deep, but also for the following reasons.

Though Shells are of such different appearances in their different growths, I will venture to establish an axiom as incontestable; by which the accurate and

judicious Naturalist shall always be capable of distinguishing the species by the Shells alone, though he has many of the same kind, of very different appearances, before him: for every species has one or more particular specific character, either in work, colour, or substance, &c. which it retains through all its various stages and forms, and therefore is always to be distinguished and known by it.

Mr. Adanson drew a conclusion of the different Shells he proposes for the species of the Black Limpet, from the situation of its eye or beak being at two thirds of the length of the Shell. This situation of the eye, he, for want of accuracy, thought to be a particular character of the Black Limpet: but he overlooked, or did not know, that the eyes or beaks of many other species of Limpets are placed in like manner, or at two-thirds of the length of the Shell. He therefore erred as much in making that particular the
criterion

criterion of the Shell, as in making the fish only, the criterion of the whole animal, or fish and shell.

But to produce some instances of what I advance, the Goat's Eye Limpet¹ wears perhaps as many different appearances as any species of Shell, and even often greatly resembles others; but look only on its ridges, the character of which is to be three-edged like a triple-edged spear or sword, and it is immediately recognized through its different appearances.

The Garnet Limpet^m has in like manner many different appearances; nevertheless its elegant garnet-like semi-transparent eye or top always characterises it through all its colours and forms.

¹ Anonymous New Conchology, Plate 2. fig. 1.

^m Id. Carbunculi oculus, Pl. 2. fig. 4. p. 10. N^o 4.

The small Blue-rayed Limpetⁿ of our coasts is, when young, thin, horny, and very conical; when old, thick, flattish, and misshapen; yet its few blue streaks always characterise it.

The Bloody-tooth Nerit is known through all appearances, by the blood-like spots on its teeth.

Each volute has some particular streak, band, spot, or colour, which it preserves through all its stages.

Even the Rocks or Murices, the Spiders, and the Winged Shells, whose appearances in their several growths, above all other Shells, are so extremely different, that when young they have narrow, sharp, thin, smooth and even lips, and the opening is pretty clear or free; when old, this lip is greatly ex-

ⁿ Id. *Patella integra exigua, lævis, cornea, cœruleis lineis insignita.* Plate 4, fig. 4. p. 20. N^o 4.

tended, very thick, pronged or set with large spikes, and almost closes their mouth or opening. Yet even all these Shells, either in the turban, body, tip, work, or colour, have constant and fixed characters, which distinguish them throughout all these extremely different appearances.

It is needless to enumerate other instances; they will occur in the several classes, as we proceed. I will therefore close this subject with the following reasoning; *viz.* Granted that the various growths or stages of the inhabitant animals change the forms and colours of the Shells so very greatly; it evidently ensues, that the animals themselves must undergo as material changes in their forms. It cannot be otherwise; for the Shell must always answer to the animal, and its ways of life; therefore, if great changes happen to the animal as well as to the Shell, we remain in equal un-

certainty as to an arrangement by the fish, as by the shells: but as the Shells have the most obvious and eligible characters, and are more easily attainable, the methodical arrangement from them is certainly to be preferred.

The *term* of *Conchology*, applied to this branch of Natural History by all authors, is quite applicable to its arrangement by the Shells, and not by the fish.

SECTION II.

I shall now proceed on another general part of the subject; that is, to give some account of the works, written solely or professedly on Shells, in order to enable collectors to make a proper choice of authors.

Buonanni, *Ricreazione dell' Occhio, e della Mente, nell' Osservazione delle Chioccioline*, printed in Italian, in 4to, at Rome, in 1681, is the first professed work
on

SECTION II. 25

on the subject. It was afterwards translated into Latin by the Author, and was republished with additions, also in 4to, and at Rome in 1684, but this Latin edition is rare.

Buonanni's work gives us a series of figures of the several species of Shells, to the number of 450 in the Italian edition, and of 550 in the Latin edition; they are most of them tolerably well engraved, but faulty in that the Shells are reversed by the inaccuracy of the engraver. He accompanies each with its particular description; but the descriptions are not good, being too concise and uninstruative; he besides gives several philosophical chapters on the origin, nature, forms, colours, properties, and other curious particulars of Testaceous animals.

The next is Listeri *Historia Conchyliorum*, published in folio, at different times, from 1685 to 1692. It is an excellent

cellent work, and I do not hesitate to pronounce it the very best, though the second on the subject, that ever was printed.

This work, which consists entirely of engravings, has the following faults, that render the copies more or less perfect. First, no two copies are found to be exactly alike, it is subject to so many variations. The plates about 1067 (in the most perfect copies) are augmented or diminished, misplaced, or corrected, at different times, according to the fancy or subsequent discoveries made by the author; it is therefore very difficult to quote the work in such a manner as to be quite answerable to other copies. The engravings are very elegant and accurate, and were done by his two daughters, Susanna and Anne. In regard to descriptions there are none, but what the synonyms infer, which are generally very good. The native countries of a few are

are also added, but the greater part are mere engravings without any name: and though the many divisions of the history into books, parts, sections, and chapters, seem very puzzling and confused, yet an accurate observer will find, that they are proper and necessary to the methodical arrangement, and the minute and nice disposition of Shells Dr. Lister proposed.

This difference in the several copies has induced a French author, Mr. Davila, in his *Cabinet*, vol. iii. p. 231, to give a collation of his copy with that in the king of France's library, from M. de Bure, who in the second volume of his *Bibliographie Instructive*, has also many pertinent observations of the different times of taking off the plates: by the account M. de Bure gives, it appears that the French king's copy is a very perfect one, and was presented to that Royal Library by Dr. Lister himself.

I have

I have also collated some copies of this work, and found them all to disagree: the most perfect copy in London is said to be in the library of the College of Physicians.

Some foreign Naturalists have been pleased to call Lister's History a dry and sterile work, alluding to its having no descriptions, but only synonyms, though in all other respects they extol it greatly. But Mr. d'Argenville has carried his censures on it beyond prudence or sense: therefore it behoves me to take some particular notice of that author.

For example, he insinuates, that of the first book of terrestrial Shells, three parts of them are known to be marine ones. Later discoveries, without any accusation of Lister, may have illustrated this point since his time, were it really so; but, on the contrary, it appears to me an erroneous assertion.

His

His next criticism shews him divested of common grammatical knowledge : his words are, the third book of Lister is of Bivalves ; he mixes the families with the Murex or Rock, and calls some Pecten Muricatus, Spondylus Muricatus, &c. Argenville certainly might have spared the press from groaning under such trivialities, had he known common expression : for the word *muricatus* has no dependence on *murex* at all ; it is an adjective, of itself grammatically signifying any subject rugged, or full of sharp points. Yet this poor critick would strive to prove, that Lister, by his Pecten or Spondylus Muricatus, joins, as he expresses himself, two different families of Shells together, and means a Rock Turbinite Escallop, or Rock Turbinite Spondyle : whereas he means no more than a Muricated or Thorny Escallop or Spondyle, without any relation or tendency to the Murices or Rock Turbens. He also criticises Lister's adjectives of *margaritiferus* and

and *echinatus*, in a like ignorant manner; for the former term signifies only a pearly-coated Shell, or, as the French even now answerably express it, *une Coquille Nacrée*; and the latter, or *echinatus*, only a Shell set with thorns or spines, like the Echini or Sea Eggs.

Another very detrimental and presumptive criticism I must also take notice of; a few lines further, he tells you, that Lister in his fourth book makes all univalve Shells Buccina; for example, the Limpet he calls Buccinum læve Discoidium, or flat Buccinum, the Sea Ear Buccinum perforatum or perforated Buccinum. It is a false assertion, grounded on his ignorance of language: Lister indeed intitles his fourth book de Buccinis Marinis; but there the term Buccinum is used by metonymy or transposition of names, for Univalves in general; for the term of Univalve is of modern date, and was never used by Lister, nor
any

any other author before him, or in his time. Thus a later author, Gualtieri by a like metonymy, calls his third part, which comprehends all the univalve turbinated Shells, *Cochleæ Marinæ*. Therefore you will find that Lister, in the synonyms of each section or family, never repeats the term *Buccinum* again, but only the very generic name of the respective families, as *Patellæ* or Limpets, *Vermiculi*, *Nautili*, *Cochleæ* or Snails, Cowries, *Rhombi*, &c. and uses it only again in the very genus of *Buccina* or Whelks, as the particular name of that family: and in like manner Gualtieri uses the term *Cochlea*.

These criticisms, to disparage Lister's work, are closed by an insinuation of a yet more hurtful and envious nature, viz. the very last lines of his account are thus worded: "One may say, that not any author has thrown so much confusion on the History of Shells as Lister, otherwise" "wise

“wise a good philosopher, and a great
“physician.”

I should not have troubled my Readers with such unentertaining criticisms, had not Argenville's Conchology been a work so greatly in vogue among the Collectors, and so universal, as it is wrote in French, the *fashionable language*. Impressions therefore to the disadvantage of Lister, had not these erroneous insinuations been hinted at, must consequently have taken place in the minds of the curious in this branch of Natural History, and have led them to reject a most excellent work for the trivialities of a writer of very inferior merit.

I will moreover be bold enough to assert, that Listeri Historia Conchyliorum is a most useful work, as perfect as any other since published, and of great consequence to those who make the Natural History of Shells their study.

There

There was published in 1770, another edition of this excellent work, in large folio, by the Reverend William Huddesford, of Trinity College, Oxford, and Keeper of the Ashmolean Museum. I wish I could add more, than that the public is indebted to the late learned editor for the republication, as Lister's work is become so scarce; but the indexes and other additions are very trivial, and there are also errors and inaccuracies in it which do no honour to Lister's memory.

I do not think it unentertaining to relate some circumstances relative to this useful and costly work which have occurred to me on the collation of many copies of the old editions of Lister, and on a collation of numbers of his proof prints dispersed among the curious by Dr. Lister himself, before the names or numbers on the plates were added to complete the work: these proof prints, which are what the print collectors stile *variations*, will

D lead

lead us into some curious particulars that otherwise would have been unknown.

Dr. Lister, in 1678, published his *Hist. Anim. Angliæ*, in which he treats of the English Shells, and gives excellent figures of them, and good descriptions; he therefore designed this work (his *Hist. Conchyl.*) only for exotic or foreign Shells, as evidently appears from the proof head plates of the first book, N^o 8, 25, 33, 40, 43, 63, 74, 83, 99, 108, 125, and 136, which are entitled *Cochleæ*, *Buccina*, &c. *Exotica*, but the word *Exotica* was erased when he changed his mind to make it a general history of Shells, which probably was at the second book, and the erasement of the word *Exotica* is even now plainly seen in all those quoted plates.

Dr. Lister, to complete his intended work, carried home all the shells singly to his daughters, to engrave on single or detached copper plates (as is seen by the work), reserving their arrangement till he
had

had a sufficient number, some not being done to his approbation, or getting better specimens afterwards, he had them re-engraved, and therefore many Shells appear twice in his work, and in some copies only the first engraving, while in others only the second engraving, is found; this circumstance is also evident from the proof plates or variations.

Dr. Lister undoubtedly published the first edition, in detached pieces, at different periods from 1685 to 1692; and I imagine a second edition was published at one time, which was soon after the completion of the first edition of 1692.

I therefore think it a mistaken notion that there was but one edition of this work, for certainly there were two; but as the title-page and heads of the chapters, &c. are plates with the engravers (his daughters) names, and bear the same date, they appear only as one and the same edition.

However, there are marks by which these editions may be distinguished by an accurate critick, *viz.* 1. The second edition has 75 Shells more than the first. 2. In the preface plate, p. 4, the third paragraph, begins *Septuaginta autem, &c.* the second edition has *Centum autem, &c.* 3. In plate 7, which specifies the places where they are found, the first edition has only one column of names, whereas the second edition has a name, *viz. Fret. Magel.* in a second column. 4. The title and all the head plates, as 1, 2, 3, 100, 106, 139, 140, &c. are printed, partly in black, and partly in red letters; whereas in the second edition, only the title, plate 1, is printed in red and black letters, all the others being printed only in black letters.

In regard to the differences in the copies, it should be observed, that as the work is entirely iconical, or consists only of figures without any letter press, catch word, alphabet, or number to the pages, it was new and uncommon to the bookbinders:

binders: they therefore committed numerous mistakes, and I attribute these differences to them and not to the work itself, which circumstance those who reject Lister's work have not reflected on.

The third publication, in date of time, is Rumphius's *Rarity Chamber of Amboina*, in folio, printed first in Dutch at Amsterdam in 1705, another edition in 1711, and another in 1745. The little currency of the Low Dutch language, and its having only been translated into German, and printed at Vienna, in folio, in 1766, has partly flung a mist on this work; and the figures, in general very good and correct, have only been consulted. However, Rumphius in his accounts of the Shells is very accurate, and is well worthy the perusal of the student. It is indeed surprizing to me, that this work has never yet been translated into a more current language, since it would be of great advantage to the knowledge of Shells, especially those of that part of the East Indies.

Petiver, in his *Gazophylacium*, has copied, in twenty-two plates, Rumphius's figures, both *Crustacea* and *Tef-tacea*, with a meer nominal index; he styles it *Aquatilium Animalium Amboinæ*, &c. *Icones & Nomina*, containing near four hundred figures; but never mentions Rumphius's name in particular, or as borrowed from him;—the figures are very indifferent, the subjects are confusedly mixt, and the index is very trifling or un-instructive, and often erroneous.

The *Museum Kircherianum*, by Buonanni, in folio, in Latin, Rome 1709; this work is rather the description of the natural and artificial rarities of the collection of the famous and learned father Kircher, and not professedly wrote on Shells; but as the twelfth class, or latter part, is intirely on Shells, with their figures and descriptions, to the number of about five hundred and eighty-six, this book has generally been esteemed as a *Conchology*, or work on Shells.

It

It is, indeed, if I may so express myself, another edition of Buonanni's former work, with additions ; and the figures are in general good, but reversed.

Janus Plancus de Conchis Ariminensibus minus notis, in Latin, Venice, 1739, in 4to, with figures. Another edition in 1748, and another also in 4to. but with great additions, at Rome, in 1760. The plates are extremely good, and his accounts very learned. It is a natural history of some testaceous animals of Rimini, in the Adriatic sea, more particularly of minute recent *Cornua Ammonia* and *Orthoceratitæ*, now first discovered in the sea-fands of that place.

La Conchyliologie of Mr. d'Argenville, in French, Paris, 1742, in 4to, with thirty-three plates : and a new edition in 1757, also at Paris, and in 4to, appears the next on the list.

This author has, in the first part of the work, not only treated his subject philosophically, but also œconomically, in ten chapters, and a preliminary discourse on the formation of Shells, the different methods of arrangement, the manner of cleaning them, their uses, on fossil Shells, and their origin, and an account of the principal Musea of Natural History now in being.

The other part is the history of the Shells, ranged in their respective classes, with proper tables and characters, Indexes, and remarks to each. The plates are twenty-nine in number, for the most part elegantly and correctly engraved from the author's own designs. Twenty-eight of them amount to near five hundred figures of recent shells; the last, or twenty-ninth plate, is of fossil Shells. The descriptions of the Shells which accompany the plates are generally too concise or rather imperfect.

This

This work in the whole is excellent, though not perfect, as it does not comprehend the whole series or species of Shells discovered : but, as the author himself observes, it is only a number of the finest and rarest sea, river, and land Shells, many of which have never been engraved before. The expence, says he, would have been too great to have engraved all that are methodized in the work ; besides that the greater part are to be found already figured in Buonanni, Lister, Rumphius, and other Conchologists.

The second edition is augmented by three elegant plates, containing thirty-three univalves and eight bivalves, with their descriptions, and the Zoomorphose or representation of the animals which inhabit the Shells.

This curious addition, or account of the animals, is illustrated by nine elegant copper-plates of them and their Shells, of the different families, as well natives of the Indies as of Europe, Gual-

Gualtieri Index testarum Conchyliorum, &c. in large folio, in Latin, Florence, 1742. This work contains one hundred and ten plates of Shells, besides several large tail-plates of Corals. The figures in general are extremely good and accurate, but are oddly placed on their tips or points, as if spinning. The reading or explanation of the Shells, not Corals, consists merely of his own synonyms, sometimes somewhat descriptive, without any synonyms or references to other authors : so that it is a meer Index, or very sterile and imperfect. Besides the dedication to the Emperor Francis III. also great Duke of Tuscany, some account of the work is given in seven other pages, and a System of Tournefort, never before published, and his own arrangement, in six other pages.

Jacobi Theodori Klein Tentamen Methodi Ostracologicæ, sive Dispositio Naturalis Cochlidum & Concharum, in suas classes, genera, & species, Iconibus singulorum
generum

generum *Æri incis* illustrata, &c. in Latin, at Leyden, 1753, in 4to. This work exhibits Klein's System of Shells, with the synonyms of authors, and Indexes of all Lister's Shells disposed according to his method. It has twelve plates, which are but indifferent; and to it are added two dissertations, viz. on the form, growth, and colours of Shells, and a critical one on Pliny Hist. Nat. lib. ix. c. 33. of the differences of Shells.

George Geve, a celebrated painter at Hamburgh, published a work on Shells in German and French, intitled, 'The Monthly Pleasure of Shells and Sea Productions, with illuminated plates, at Hamburgh, 1755, in large 4to. This work only gave the Description of the first five families of Shells, and was well received by the public, but, being pirated, was discontinued. It had a systematical order for a ground-work: there are only twenty-four plates published, with 265 figures of Nautili, Post-horns, Dolphins, and other
 Snails

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Snails and Nerits ; but the descriptions reach no farther than the 175th figure, and are comprised in fifteen pages, columnwise.

^a A Treatise on Shells and other marine bodies of Amboina, and the neighbouring islands, by Francis Valentyn, Clergyman, at Amboina, Banda, &c. with fine cuts ; as also Notices, serving as a Continuation to Rumphius's Rarity Chamber, Amsterdam, 1754, in folio. This work is in Dutch. In the account of the East Indian Shells the author follows Rumphius chapter by chapter, makes additions to their Indian names, their places where found, their varieties, and the new species discovered ; he further notices the Shells

^a Verhandeling der Zee Horenkens en Zee gewassen in en omtrent Amboina, en de Nabygelegene Eilanden Door Francois Valentyn, in zyn leven bedianaar des Goddelyken woords in Amboina, Banda, enz, Met zeer Nette Prentverbeeldingen Verrykt. als mede Het Afbeeldzel van den Schryver. Diende tot een vervolg Van de Amboinsche Rareitetskamer beschreyen Door G. E. Rumphius,

of

of any rare or valuable species, as the Ventletrap, Admirals, &c. in whose collections they are, and their original prices.

He gives like accounts of the West Indian and European Shells; as also enumerates the collections made by the Dutch in the East Indies, from Rumphius's going there in 1655, and of the chief collections in Holland, with lists of the most capital Shells in each collection.

The whole is embellished with sixteen copper-plates of Shells, well engraved, containing one hundred and four univalves and thirty bivalves.

This is a curious but not a scientific work. And in two large, or sheet plates, wherein he has figured some sea plants, and some fish, he has given a fine figure of a Mermaid as vulgarly painted; this ridiculous circumstance alone has degraded his work among the *too lively* collectors.

Les Delices des Yeux & de l'Esprit, ou collection generale de differentes Especes de Coquillages que la Mer renferme, communiquée au Public, par George Wolfgang Knorr, à Nuremberg, Partie I. 1764. II. 1765. III. 1768. IV. 1750. V. 1771. & VI. 1773. The five first parts contain each thirty plates, and the sixth part forty plates, besides the letter press or their descriptions in French, the Indexes, &c. This work treats of the Shells without any order or system, and the figures are for the greatest part extremely well done.

Adanson, Histoire Naturelle du Senegal, tom I. Les Coquillages, Paris, 1757, in 4to. in French. This author is a topographist, or describer of a particular country, viz. Senegal in Guinea. The first part of the book relates to his voyage and residence there from 1749 to 1753. In this relation he only notices the particular customs, &c. of the people, and the occurrences which happened to him; and informs us, he designs to treat of the natural

tural history, fully, in other parts of the work ; he therefore begins with the history of the Testaceous animals of Senegal, which makes the second part of this volume, and is the only one, to my knowledge, he has yet published.

This Natural History of testaceous animals is illustrated with nineteen copper-plates, not only of the Shells, but even of the fish of each family, to the number, as he tells us, of one hundred and eighty-five species, and above four hundred figures: they are mostly well engraved and correct.

Seba's Museum, intitled, *Theauri Rerum Naturalium locupletissimi Alb. Sebæ accurata Descriptio, cum Iconibus, &c.* printed at Amsterdam in 1758, in large folio, in Latin and French. This is the third volume of the description of the fine collection of Natural History of Albert Seba, an apothecary, at Amsterdam ; which noble collection has suffered the fate of most others, and is now dispersed.

This

This third volume treats on marine subjects, as fish, crustaceous and testaceous animals, and corals ; and the Shells alone make a great part, for the whole volume is illustrated with one hundred and sixteen plates, of which from plate thirty-five to ninety-four are all of shells.

Seba's is a most costly and noble work, but without any prejudice might have been rendered less expensive and more useful, by numbering the Shells, which is wanting in some plates, and also by retrenching many of them, and the repetitions of the same Shells to form compartments and Shell-works, as they were placed in his collection ; as for example, plate 35, 36, 37, and 85, which are whole sheets, shewing compartments, flower-works, and carvings on Nautili ; and the repetitions of the same shells in other plates, especially 53, 58, 90, 92, &c. a prodigious expence, and of no utility whatever. The engravings in general are correct, and the descriptions good.

Recueil de Coquillages, de Limaçons & de Cruftacés, peints d'après nature, gravés en taille douce, & illuminés de leurs vrais couleurs, par Francois Michel Regenfus, and published by the order of the king of Denmark at Copenhagen, in 1758, on a very large folio paper.

This royal work has twelve plates finely illuminated; and the letter press, which is in German and French, contains, besides the dedication and preliminary epistle, the Natural History of Shells, in two parts. Part I. consists of twenty-eight pages; and part II. of fifty-four pages. A second volume of this work has been begun, and a considerable progress is made in it; but as the ingenious author colours every plate by his own hand, the progress is consequently slow.

Martini on Shells, intitled, the New Systematical Cabinet of Shells, by Frederick William Martini, printed at Nuremberg, 1768, in 4to*.

* Neues Systematisches Conchylien-Cabinet Geordnet und beschriben, Von Friedrich Heinrich Wilhelm Martini, &c. Nurnburg.

This publication is the first number, or part, of a Conchology, designed to be given at different periods, by the said Mr. Martini, a physician at Berlin; the reading is German. This first part contains the families of Worms, Limpets, Sea-Ears, Nautili, and other chambered Shells; and has twenty-two plates, besides head and tail plates of Shells and their fish, and of Corals.

The twenty-two plates are coloured, the head and tail pieces are only printed in red, and are good; but many of the plate-figures are very incorrect, and the colouring is too glaring and unnatural. This author, however, is more historical and accurate than any other, and his synonyms or references of authors are mostly very correct, and his descriptions good.

The second part, which compleats a first volume, was published in 1769: this contains from plate 23 to 31, and in all to

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340 figures, and their descriptions; it exhibits the families of the Bullæ and Cowries.

The third part was published in 1771: it continues the history to figure 415 and to plate 45, figure 481; and comprehends the families of helmets, veneroidæ, cylindroidæ and cylindars or olives.

A new anonymous Conchology began to be published in this Metropolis in 1770, in folio, illustrated with copper-plates. It was to be published in monthly numbers, and each number to contain two plates of Shells, with their descriptions in English and French. It was also intended to be a General Natural History of Shells, and to include the figures of all the known species, common as well as rare, beautiful, or otherwise; and some copies were designed to be accurately coloured for the use of the curious. Six numbers of it were published, comprehending the fami-

lies of the Limpets, Sea-Ears, and Worms ; but not meeting with suitable encouragement, the authors have laid it aside, at least for the present.

Natural histories, without figures of the objects, are at best imperfect ; for at one view figures impress the idea of the body much stronger than the most finished or accurate description. It is for that reason, in the above list of authors, I have only mentioned those with figures, as they of course must strike the mind, and aid the knowledge of the study.

However, it remains yet requisite to recite some few other writers, who, though they have not illustrated their works with proper figures, still merit attention.

The first of these is John Daniel Major, a physician of Kiel, in Holstein, who republished Columna's excellent work *De Purpura*,

Purpura, with learned annotations, so early as 1675, at Kiel, in 4to*.

He therein gives a method or system of testaceous animals, which he pretends will immediately, on inspection of any one shell, capacitate a person to place it in its proper rank. For this purpose he forms ten tables, which are too prolix to specify here. It is proper to observe that his chief merit consists in being the first who has formed a method of Shells; for it is more speculative than practical. It is indeed only good to shew at one view all the different forms of Shells, for he does not properly distinguish their genera and species.

* Fab. Columnæ Opusculum de purpura, cum Annotationibus Joh. Dan. Majoris, cui adjecit specimen de testaceis, ad prædictas annotationes illustrandum, & insuper ad Conchyliæ & Testacea reliqua in Principum Conclavibus disponenda facile inserviendum, cum Dictionario Ostracologico, Keil, 1675, 4to.

The next in date is Langius*, a physician of Lucerne, in Switzerland, who, in 1722, published, in a thin quarto, in Latin, a New and Easy Method of Shells, disposed in their due classes, genera, and species, but without a single figure.

This author, in his title-page, which is very prolix, gives us his reason for not having figures, as he refers to the icons, and recites the synonyms of the chief authors on Conchology, and gives sufficient characters to his classes and genera; he further notes, that his work was principally designed to elucidate the fossil testaceous remains,

* Caroli Nicolai Langii, &c. Methodus Nova & facilis Testacea Marina, pleraque, quæ huc usque nobis nota sunt, in suas debitas & distinctas classes, genera, & species distribuendi, nominibusque suis propriis structuræ potissimum accommodatis nuncupandi, &c. &c. Lucernæ, 1722, 4to.

Breynius

Breynius de Polythalamiis, Dantzick, 1732, in 4to. has given us, from p. 3 to p. 5, his thoughts on Shells, and a short system : which scheme he afterwards printed in a loose sheet, without date, place, or author's name.

The fourth author is the celebrated Linnaeus, who, in his several editions of his *Systema Naturæ*, has methodized the testaceous animals ; but more fully in his last or twelfth edition, published at Stockholm, in 1767, in 8vo. This learned naturalist has given a few bad figures, in some of the former editions.

Mr. Davila, in his *Catalogue Systematique & Raisonné des Curiosités de son Cabinet*, printed at Paris, in 1767, in French, in three volumes in 8vo. This fine collection was sold at Paris the following year. The first volume only treats of Shells, and is illustrated with twenty plates of rare species. Most of the figures are good ; and this work, though a meer

catalogue of the sale, contains many curious and interesting particulars.

Another 8vo catalogue of a sale, intituled, *Catalogue Syſtematique des Coquillages de Arnold Leers de Rotterdam*, ſold in May, 1767, at Amſterdam. This catalogue was wrote by Mr. Fred. Chriſtian Meufchen, Envoy for ſome German Princes at the Hague. It contains a ſheet ſyſtem of Shells, beſides many obſervations diſperſed in the catalogue.

The laſt work I ſhall particularly recite is a ſmall book, printed at Paris, 1767, intituled, *Conchyliologie Nouvelle et Portative*, in which, like as in a Dictionary, the Shells are recited in an alphabetical order. It is a very inſtructive book, and worthy the peruſal of every collector.

There are ſome other treatiſes on Conchology, which are rare, or little known; as, V. A. Walenbroeck's *Cochlearia Curioſa*,
Leipſ.

Leips. 1674, 8vo. & Jo. Ern. Hebenstreit de Ordinibus Conchyliorum Methodica ratione instituendis, Leips. 1728, 4to, &c. Besides which, most of the naturalists and museographers have included Shells in their works, as Aristotle, Pliny, Bellonius, Rondeletius, Gefner, Aldrovand, Imperatus, Wormius, Calceolarius, Moscardo, Grew, Vincent, Sloane, Petiver, and a number of others.



SECTION III.

HAVING finished the review of the authors on this branch of Natural History, I shall proceed on two other general points, viz. of the uses of Shells, and instructions for collecting, cleaning, and preserving them.

I observed on setting out, that this part of the creation seems more adapted as a link or harmony of Nature, than as oecconomical, or of immediate use to mankind. Most part of the animals are nourishing food, though not solely or for constancy, as beasts, birds, fish, and vegetables are ; not any nation, to my knowledge, having been mentioned to subsist on them alone. In medicine their shells or habitations are of some use ; and, in agriculture, a manure of recent shells, sea-sand, or comminuted shells, and the fossil shells of the craig-pits
in

in Suffolk, and of the falunieres in France, are in great esteem.

The beauty, politure, and hardness of shells, render them very fit for luxurious uses ; and toys and ornamental utensils, &c. are frequently made of them.

The morbid state of some species of bivalves yield, next to fossils, the most precious and valuable luxurious article of any other parts of Nature, I mean Pearls.

Before the discovery of silk and of cocheneal, this branch of Nature yielded two other luxurious articles to civilized nations, which, by these discoveries, are now rendered of no value and useless ; to wit,

The Tyrian purple, made from the liquor of a species of turbinated univalves first discovered at Tyre, and for which that city was famous, this dye was accounted so beautiful and so precious, that it became a peculiar mark of royalty and grandeur.

However,

However, later discoveries prove, that it is not peculiar to one species only, but that several kinds, nay, different families, afford and effund this purple juice : indeed a whole family of Shells still retain the name of *Purpuræ*, or purples, from this property.

The same and costliness of the dye, the manner of dying, the prodigious prices, and all other particulars of it, which are foreign to my present purpose, may be seen in the Grecian and Roman naturalists Aristotle and Pliny, as also in Aldrovandus, Columna, and other modern writers.

The costliness of the dye proceeded from the small quantity of the purple liquor each shell fish yielded ; and that it was absolutely necessary to get it from the fish when alive and fresh ; and also, that myriads of animals scarcely yielded liquor enough to dye a mantle.

But

But the cocheneal insect, an American product, quite unknown to the antients, which affords so fine a scarlet dye, being now got in quantities, and to be used, preserved, or dried, and at all seasons, makes it not only cheaper, but more useful ; and therefore has now intirely overthrown this rich or royal dye of antient times.

However, authors say that it is still in some use in the Spanish America : we have a species of purple shell-fish on the coasts of Somersetshire, Cornwall, and other parts of England, also on several coasts of France, and other parts of Europe ; but no other use is made of them than to mark linen, and no lixivium or art can efface the colour. Mr. Cole gives a very curious account of the Somersetshire Shells in the Philosophical Transactions * ; and
Mr.

* Phil. Trans. N^o 178, table iii. fig. 3, 4, 5, 6, 7, by Mr. William Cole of Bristol. It is a white vein, lying transversely in a little furrow or cleft, next to the

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Mr. Du Hamel of those of France, in the History and Memoirs of the Royal Academy of Sciences of Paris.

The Byffus of the antients, which I am convinced was made of the beards of the Pinnæ Marinæ, or Sea Wings, and such like bivalves. The Pinnæ Ma-

the head of the fish, which must be digged out with the stiff point of a horse-hair pencil.

The letters, figures, spots, or what else shall be so made, will presently appear of a pleasant *light green colour* ; and, if placed in the *sun*, will change into the following colours ; First, a *deep green*, then a full *sea-green*, after into a *watchet blue*, then into a *purpleish red*, and lastly, into a very deep *purple red*, beyond which the *sun* can do no more. But then the last and most beautiful colour, after washing in scalding water and soap, and dried in the *sun*, will be of a fair bright *crimson*, or near the *Prince's colour*, which will continue, though there is no use of any stiptic to bind it.

The changes of colours are made faster or slower, according to the degrees of the *sun's* heat.

While the cloth so dyed lies in the sun, it will yield a very strong foetid smell, like *garlick*, or *assæfætida*.

rinæ,

rinæ, by some are called the *Silk-Worms of the Sea*. They have beards, by which they fasten themselves to the rocks, &c. of fine, long, glossy filk-like brown fibres, which are easily wove into a filken stuff. There are now manufactories of it at Naples, Messina, and Palermo.

Those bivalves, says Mr. Adanson, which have such beards, (for only bivalves are yet discovered to have them) have them sometimes in separate fibres, as the Pinnæ and Muscles, or united, as it were, into one nerve, as the Arks. These threads, or fibres, proceed from the beginning of the pedestal of the fish, and are analogous to the hair of other animals, or the nerves and fibres of Quadrupeds. The Shells which have these beards remain fixed in the same place; and when the fibres, or threads, are cut, or broken off, they immediately spin, or form new ones, with their pedestals, which is the part that conducts the work, and by this means refix
6
themselves

themselves to the rocks, or other immovable places they meet with.

In regard to instructions for collecting, cleaning, and preserving Shells, fit for observations or cabinets, I shall offer the following hints :

For collecting. It is always necessary, if possible, to get them alive, or with the animals in them. It not only instructs us in the natural history of the very animals, a part extremely useful to a thorough knowledge of Shells, (though as I have already advanced, it is not necessary to form the method or system of them) but it also preserves the Shell in its perfect nature and beauty ; for only live Shells bear the full glow of their colours.

When any Shells with their fish are collected, I would not have them immediately killed, but kept for a few days in their native sea water (not longer, for
the

the fish waſting or dying in the Shells muſt neceſſarily hurt them) to make obſervations, if poſſible, of their motions, ways of life, &c. and ſome deſcriptions of them ; for univalves, principally, if with or without horns, their figure and ſituation, and the form of the pedeſtals, &c. In regard to bivalves, I do not find any particular part is eaſily obſervable, that is, without anatomy ; therefore the whole form, colour, and other remarkable and very obvious parts, are only neceſſary to be deſcribed. Theſe obſervations are pretty eaſily made, and without any great aſſiduity ; but, ſhould the perſon who collects them be of a curious and inquiſitive nature, he may puſh his reſearches to what extent he pleaſes, to the advantage of Natural Hiſtory.

Live Shells may be fiſhed up by drag-nets, the log-line in ſounding, the cable in weighing anchor, or ſuch-like workings.

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The collector must likewise have some judgment in the picking of such Shells, for sometimes they are found, though alive or with the fish in them, bad, or worn through age, pierced with worms, or other accidents, which makes them yellow, livid, and imperfect.

All species of Shell-fish, like other animals, have their particular or peculiar resorts ; some are pelagian, or inhabit only the deeps of the sea, others keep in less depths ; some in shallows and in bays ; and some are even littoral, or inhabit the very shores.

However, let their resort be what it will, get the Shells from the deeper parts of those resorts ; for, if in too shallow water, they are more exposed to the sun, or other accidents, which hurt them much.

It has been observed, that as fine species as any are met with in narrow straits between

tween islands, and in bays ; as also shallows of four or five fathom water.

After violent storms live Shells may be picked up on the sea beaches or shores, as the great agitation of the water, during those hurricanes, raises, and brings them from their native beds. But then they must be collected as soon after the storm as possible, the sun fading their colours, and spoiling their beauty. As for Shells that have lain some time on the shores, known by the name of *Dead Shells* among collectors, they are seldom of good colour, by being exposed to the sun, and are also often imperfect, from being bowled to and fro, and by that means worn and broken.

Of the Shells that adhere to rocks, bottoms of ships, &c. always chuse those which lie under water.

Land and River Shells are more easily obtainable ; and the collector needs no

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other instructions, but only to be judicious in his choice.

The River Shells in general are observed not to be of a pleasing colour, or to have any great variety of colour; therefore, in that point, they are less curious than the Land or Sea Shells.

River Shells are most generally also extremely thin, some have even imagined it a character to distinguish them; but they are mistaken, for though in general River Shells are thin, yet we find Sea Shells as thin; witness the *Cymbia*, or Paper Nautilus, some Pinnæ, and many other Sea Shells, as also many Land Shells.

The above is sufficient for collecting Shells. Now, to preserve them. As Shells are of a calcareous nature, all acids should be avoided as much as possible; and even when you kill the fish, as continued boiling them may detriment the Shells, I
would

would advise only to give them a quick dip in strong boiling water, which alone will kill the fish : and soon after, but giving them time to discharge the heat acquired by dipping (that they may not immediately pass from one extreme to another, or from hot to cold, and by that suffer some injury), fling them into pure cold water, to lie till you intend to clean them, or for some little while.

As by being thus managed the fish becomes condensed, or somewhat solid, it is afterwards easily picked out of its shell by pins, or such sharp instruments.

The above is meant for turbinated univalves only ; for as to Limpets, and such open Shells that are not spiral, and all bivalves, the fish are easily got out with a knife : however, care is to be taken not to cut, or otherwise hurt the ligaments or muscles of them, nor to mismatch the Shells, should you happen to funder or separate them.

In cleaning or preserving Shells for cabinets, take the following hints : Let them not be touched much by aqua fortis, or by any other acid, as oil of vitriol, spirit of salt, or even vinegar ; nor be boiled, or exposed to the heat of the fire, or sun, for they greatly spoil them.

Many Shells are fished up extremely beautiful and polished, so perfectly, that art cannot better it. These need only be ranged in their respective classes : such are the Cowries, Tuns, some Buccina, the Volutes, and the Olives.

Others, on the contrary, come out of the sea slimy, and even sometimes covered and encrusted with filth, coralline matter, moss, &c. and have a pellicle or epidermis ; such are the Tellens, Muscles, Snails, &c. For these, first steep them a day in hot water, to soften the filth or crust, then brush them very much (but the brushes should not be too hard);

if

if that does not compleat the cleaning, I would advise to rub or brush them again with tripoli or emery, or a weak acid, or with a stronger one, much diluted with water ; always taking care to dip them every minute in clear cold water. Strong soap may also be used with a rag or piece of woollen or linen, with which rub them; and when sufficiently cleaned this way, a fine brush, with fine emery, will finish the whole. But all these processes must be judiciously managed according to the attendant circumstances, which it is impossible to regulate in writing.

The scientific collectors, or naturalists, are always desirous of having the Shells in their rough state, or just as they are fished. This method, though extremely useful, is not to be absolutely followed ; not only because their beauties would be lost, but also on account that the species differing in colours could never be truly defined. However, as a medium, I would advise all

collectors to have some Shells of each genus in their rough state, while the others should display their beauties by all the accomplishments of art : and a more easy medium may be kept in bivalves, by one shell or valve being rough, while the other is polished.

Numbers of Shells have an outer skin, or pellicle, different from the Shell itself, called the Epidermis. In regard to Natural History, it is really of use to know the nature, colour, &c. of this Epidermis, as it often characterises some species, as much as any other part. I therefore would recommend a due notice or observation on it ; and also to preserve some specimens covered with it : to enrich your cabinet with specimens for knowledge, as well as for beauty.

The Epidermis, by its thickness, hinders a Shell sometimes of being polished. In that case, it must be wholly taken off with an acid diluted with water.

And

And afterwards it is to be brushed with a brush charged with emery, putty, or tripoli, till it becomes polished, or glossy; but if, instead of a thick Epidermis, it is a meer pellicle, it is sufficient to steep it in hot water, and then pick it, or slightly file it off. Vinegar, or a weak acid, is also good, and, indeed, much better than aqua fortis.

When the Epidermis is so very crass, or gross, that acids diluted, and even pure aqua fortis, does not do; strong emery, with strong brushes, seals skin, or pumice-stone, is sometimes employed: if that does not do, the only way left, is to steep it in a cup of pure aqua fortis, in the following manner. First stop or cover the mouth or opening of the Shell with wax, that the acid may not penetrate to, or touch, the inside of it. And care must be taken, from minute to minute, or from time to time, to plunge it in clean cold water, and every time to examine what effects

effects the acid has had. It is also necessary to cover with wax all the fine points or delicate parts of the Shell, to hinder the acid from any-wise corroding or hurting them : after which the whole Shell is polished with fine emery, and passed over with gum-water, or whites of eggs.

A Shell of a smooth surface, or that is not very rugged, warted, or set with spikes, processes, &c. and which naturally has some slight politure, though dull or deadish, should only be rubbed with chamois leather by the hand. It will then become bright or glossy, especially if a little very fine tripoli is used. Indeed, powder of emery should not be often used, for it works rather too rudely. However, all these operations must be used and adapted to the circumstances, otherwise they destroy or hurt the colours, and the fine workings on the Shell.

When

When the Shells are polished enough, and quite dry, pass them over by a fine pencil with gum arabic water; which glows the colours without hurting them, or even giving any smell, as varnish does. Whites of eggs is also good; it is more glaring, but, however, it is subject to turn yellow in time.

The last and least work to be used for Shells, is working or rubbing them quite down, so as to take off entirely their true and native coat. This is done by working them like agates, or other stones, on wheels smeared with emery. This work often quite spoils them, and very great care must be taken: however, they may be polished by hard brushes of boars bristles, with a turning machine.

Patience and judgment can only overcome working of Shells that are warped, rugged, bumped, thorny, &c. A brush or a feather can only be used to convey the

aqua fortis on the parts required to be wrought on, and then it must be from minute to minute, steeped in clean water, to hinder the acid from corroding it too much; afterwards, like other Shells, they are to be polished, or passed over with tripoly or emery: even then, all parts cannot be clean alike, and gum-water or whites of eggs must be used to those less cleaned parts, to render them vivid; else they would shew but dull.

The rubbing down of Shells reproduces new ones, as they are called. Thus the Volute, called by us the *Purple* or *Violet* Tip, and by the French the *Onyx*, has a brown epidermis, which being taken off discovers the ground colour to be a dull yellow. When this is worked down to beneath the crust, or surface, it is of a pure white, with the tip of a fine violet colour.

The

The common Cowry, in like manner, is worked down to a fine violet.

The Nautilus, like many trochi, snails, and other Shells, works down to a fine mother of pearl ; but, if only cleaned, it is sullied white, with large fallow or yellowish rays.

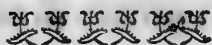
The Sea-Ears also work down to mother of pearl, whereas, when only polished, they are finely clouded brown, white, green, &c.

Many of the Limpets, when worked down, wear a very different appearance to what they do when only polished.

Several other such examples may be brought : but I neither applaud this, nor many other processes and frauds, that are
daily

daily practised on Shells, which destroy their true or natural appearance.

The Dutch are very much famed for these practices; they even colour and file Shells to such a degree, as to alter them quite: all these particulars are to be avoided by the judicious collector.



SECTION IV.

HITHERTO I have only treated of Conchology in general: I shall therefore now proceed to the particular parts, and begin with the several systems or methods of Shells established by different authors; and also lay before my readers the arrangement I propose, that they may be able to judge how far any deviations I make from those now established are judicious or approveable.

The most general manner of the old authors has been, to divide all Shells into simple, turbinated, and bivalve. It is evident that this division is very erroneous, as it entirely excludes the multivalves.

Succeeding

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Succeeding writers, instead of this substituted three other divisions, viz. univalves, in which they comprehend both the non-turbinated and turbinated; the bivalves and the multivalves.

To this last, which is the generally-received division, I adhere: and I shall adopt the term Univalve now used, though it is not very proper. My only reason for so doing is, that custom has stamped an authority on it; and I am unwilling to change a term now universally received, to avoid confusion.

I proceed to the first division, or univalves; but shall only take notice here, of those authors who have treated Shells in a methodical or systematical manner. And

First, Lister, who begins with the land and fresh water univalves, in which, in regard to method, not any thing remarkable

markable occurs ; but in his fourth book he divides his sea univalves into eleven families, viz. 1. Limpets. 2. Dentalia. 3. Vermiculi. 4. Nautili. 5. Snails. 6. Nerits. 7. Sea-Ears. 8. Trochi. 9. Cowries. 10. Rhombi, or Strombi ; by which he means olives or cylindars, figs, and some other wide-mouth Shells, and also Volutes ; and, 11. Buccina, which he subdivides into five sets, viz. 1. Those with a toothed columella or pillar. 2. Bilingues. 3. Ampullaceous, or bellied. 4. The Turban or Clavicle, and the top-lengthened or produced : and 5. The top or mouth no ways produced.

Lister's above method is indeed very confused, and no wise to be followed. His 1, 2, 3, 4, 8, and 9th families are good. I think him right in making the Dentalia a distinct family from the Vermiculi : the former being always of a regular determinate figure ; the latter, or Vermiculi, of a figure irregular and uncertain. His 7th family of Sea-Ears seems outrageously misplaced between the Nerits and Trochi ;

it should be the 2d, or following the Limpets, to which they are nearly allied; and his 5th and 6th families, Snails and Nerits, are really only one: but the greatest confusion is his 10th and 11th families of Rhombi and Buccina: they are indeed so inextricable, that it is impossible to reduce them to any order, or render them useful to the student.

However, had Lister but added an index of the numerous sections, parts, and chapters, to his work, his Shells would be very easily traced, though they seem more confusedly placed than in any other author. His arrangement, though not good in the whole, is so critically methodical, that a person the least conversant in Conchology can immediately find if a Shell is figured by him or not. For example, his chapters of the Cowries are regulated as follows, viz. Cowries of one colour. 2d. Streaked. 3. waved. 4. Simply ringed or banded, and banded and spotted. 5. and 6. spotted or painted in a nett-work.

work. 7. Striated. 8. Pimpled, or with prominent knobs. 9. Smooth-mouthed, or not toothed, as the Weaver's Shuttle, and the Poached Egg; and 10th. Umbilicated, as the Pewit's Eggs; which two last he places in the Cowry family. By this exposition it is plainly seen, that, had he made an answerable index, a person might immediately find, without turning pages over or wasting time, whether Lister figured the Cowry sought for, sooner than in any other author. However, I confess, I think it rather too much clogged, or circumstantial.

An author, whom I did not mention in my list of writers on Shells, as being only a describer of a museum, I mean Dr. Grew, in his account of the Royal Society's collection, has given us seven schemes, or systems of Shells. He divides all Shells in his first scheme into single, not whirled and whirled; into doubles, or bivalves, and into multiple, or multivalves.

His second scheme takes in the single Shells not whirled : he constitutes three families of them, the Echini, the Patellæ, and the Aures Marinæ. His third scheme takes in the conic whirled Shells, as Murices and Olives. The fourth the oval whirled Shells. The fifth, Shells more greatly whirled or produced, as the Trochi, Strombi, Purpuræ, &c. The Sixth, Shells whose whirls or windings are latent or hid within their body, as the Cowries. But, however, all these his schemes are so puzzling, and without proper definitions or figures, that they are rather to be reckoned ingenious than useful.

Rumphius has the three divisions of simple and turbinated Univalves, and the Bivalves ; as for the division of Multivalves, he has it not, but blends them with the other divisions. His families are, 1. The Chambered Nautilus. 2. The Paper Nautilus. 3. The Cornua Ammonia, or Helix Snails, called Post-Horns. 4. The Cochleæ Lunares. 5. Trochi. 6. Cochleæ Valvatæ,

Valvatæ, Nerits, or operculated Snails.
 7. Helmets. 8. Murices. 9. Cochleæ
 Globosæ. 10. Buccina. 11. Strombi. 12.
 Volutes. 13. Alatæ, as Spiders, Devil's
 Claws, &c. 14. Olives, or Cylindars, and
 15. Univalve Shells, as Limpets, Vermi-
 culi, &c. but every one of his families
 are so confused, that little aid to an arrange-
 ment can be gained from his work.

Langius discusses the general subject in
 six sections, of which the fourth gives
 his characteristical notes from the whole
 structure and figure of the Shell, or from
 the principal parts, viz. the aperture in
 the turbinated Shells, and the beaks
 (Umbones) in the bivalves. Other minor
 characters are their being fulcated, smooth,
 &c. or from the different situations of the
 parts : And also negative characters that
 are common to other Shells, as, e. g. the
 character of the first class of Univalves is,
 that they are not turbinated, or turned in a
 spiral manner ; and adds, that all characters
 laid down should be such as are strong and

visible ; and these characters should always be kept in view by the writers who set them forth. He divides all shells into, 1. Simple Univalves, or those that are not turbinated. 2. Turbinated Univalves, by which he only understands those whose whole form is spiral, and not partly so, as is the *Cyprea* or Cowrie ; and, 3. Bivalves.

His first Part, Simple Univalve Shells, or not turbinated, contains class 1. The Limpets and Vermiculi. Class 2. The Nautili, Noces or Dippers, *Cypreæ* or Cowries, and Ammonia.

Part II. Turbinated Univalves. Class 1. Of a lengthened aperture, or the mouth open on the upper part ; as the Volutes, Cyliudars, &c. Class 2. Canaliculated, or whose aperture on the upper part stretches out into a long pipe or beak, as the Murices *Purpuræ*, Helmets, &c. Class 3. Whose aperture and tip are both lengthened, and whose first, or body spine, is remarkably
6 swelled,

swelled, as the *Buccina*, &c. Class 4. Whose first, or body spire, is narrow, or tapers with the rest of the shell, as the *Strombi*, *Mitre*, *Crane*, &c. Class 5. Whose turban or clavicle is very produced or sharp, as *Strombi*, *Trochi*, &c. Class 6. Those Shells whose aperture and clavicle are little produced, as the *Snails*, *Nerits*, and *Sea Ears*,

Part III. the *Bivalves*, Class 1. Equal or similar-sided *Bivalves*, or whose cardo is central, as *Cockles*, *Chamæ*, *Tellens*, &c. Class 2. Dissimilar or unequal sided *Bivalves*, or whose cardo is not central, as *Muscles*, *Pholades*, and many others; and Class 3. *Conchæ anomalæ*, or of unequal valves, as *Escallops*, *Spondyles*, *Oysters*, &c.

It is evident, this arrangement of *Langius* is confused, and wants great correction.

Argenville divides all Shells into the three general classes, of *Univalves*, *Bivalves*,

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valves, and Multivalves. The Univalves he arranges into fifteen families, viz. 1. Limpets. 2. Sea Ears. 3. Vermiculi. 4. Nautili. 5. Cochleæ Lunares, or round mouthed Snails. 6. Semilunares, or half mouthed Snails. 7. Flat mouthed Snails. 8. Buccina. 9. Turbines. 10. Volutes. 11. Rhombi, Cylindars, or Olives. 12. Murices. 13. Purpuræ. 14. Tuns: and 15. Cowries.

This author's method is very good; but, however, there is some confusion in it; especially in the following families, viz. 7. The flat mouthed Snails. 8. The Buccina. 12. The Murices; and 13. The Purpuræ. Besides, a proper place is wanting for the Paper Nautili, which he very erroneously ranges with the chambered or common pearly Nautilus; but I shall refer to further particulars, when I treat of each family respectively.

Gualtieri arranges Shells into five parts, viz. Part I, Land and River Shells, both
simple

simple and bivalves. Part II. Sea Shells, that are simple or not turbinated, in two classes. 1. Simple, as the Limpets, Vermiculi, and Dentalia; and 2. whose fabric or structure is latent, or hid within the body of the Shell, as the Paper Nautili, Pewit's eggs, and Cowries; or that are of a chambered structure, as the Nautili, Cornua Ammonia, and Orthoceratitæ.

Part III. which he by metonymy calls Cochleæ Marinæ, as Lister calls them Buccina, comprehends all the turbinated Univalves. He ranges them into the six following classes, viz. 1. Cochleæ Longæ, or the Volutes and Cylindars. 2. Cochleæ Canaliculatæ, as the Purpuræ, Murices, Winged Shells, Spiders, Helmets, &c. 3. Buccina. 4. Strombi, as he calls them; but are not the Strombi or Needles, properly so named, but Murices and Buccina. 5. Snails very lengthened or produced, as the Strombi or Needles, and Trochi: and 6. The short Snails, or not much produced

duced or lengthened, as the Snails of all kinds, Nerits, fimilunar, round mouthed, Helices, &c. and with these he ranks the Sea Ears.

Part IV. Bivalves : and Part V. Multivalves, among which he places the Echini.

I shall comment very little on his system, and only observe, that, in all his classes, there occurs an inextricable confusion ; and that he seems to borrow his arrangement chiefly from Langius.

Gualtieri has likewise favoured the learned with a publication of a manuscript system or arrangement of Shells by the celebrated Mr. Tournefort. This method has the three usual and general divisions of Univalves, Bivalves, and Multivalves. The first is simple Univalves, as the Limpets. The second, the turbinated of all kinds ; as Buccina, Cochleæ, Cowries, &c. and the

the third family is the tubular Univalves ; as Vermiculi, Dentalia, &c.

Though Mr. Adanson only treats of the testaceous animals of Senegal, and consequently is a partial writer, or one that does not give an intire system or Method of Shells, I cannot withhold mentioning him, as he is very remarkable. He ranges all those he exhibits by the animals themselves, and not by the shells or spoils : however, he gives ten tables of affinities of Univalves ; that is to say, of the very Shells, founded on the six following parts ; the spires ; the top ; the opening, aperture, or mouth of the Shell ; the operculum or cover ; the pearliness of the substance of the Shell ; and its perioste or epidermis. He likewise gives seven tables of affinities taken from the parts of the animals ; as the horns, eyes, mouth, &c. and from these tables of affinities he forms his arrangement.

The above tables are exceeding ingenious, but useless : in that they are very perplexed,

perplexed, and require an intense study to unravel them: besides, he has clogged the whole with such unmeaning and ridiculous new names to his Shells, rejecting all former and received ones, that he makes himself very singular.

The vast and costly work of Seba offers next. It has no general system or method; but the editor, in the index of the plates, (Plate 84,) exhibits an arrangement of the Univalves: and says, he hopes to publish his whole system soon, which will comprehend the Univalves, the Bivalves, and the Multivalves, with their characters and divisions.

The system or method of Univalves he exhibits, contains fifteen families, to wit, 1. Cowries. 2. Tuns. 3. Nautili. 4. Semilunar mouthed Snails. 5. Round mouthed Snails. 6. Trochi or tops. 7. Strombi or Needles. 8. Olives. 9. Volutes. 10. Helmets. 11. Winged Shells.
12. Mus

12. Murices. 13. Purpuræ. 14. Buccina. and 15. Sea Ears. All these families, says he, proceed from a spiral, which extends or widens more or less.

In the above work, as he mentions the spiral form only, he has neither placed the Vermiculi or the Limpets. However, in his system he has given some figures of the former ; but of the latter, or Limpets, he has neither figured or mentioned a single species, in his whole work ; which is very remarkable.

Breynius divides all Shells into two general divisions of tubular or vascular: that is, into Shells that are hollow, or like tubes, and into those that are like cups or vessels. The first division he subdivides into Monothalamias, or of one cavity ; and into Polythalamias, chambered, or with many cavities. The second into simple, as the Limpets ; or composit, as the Bivalves and Multivalves. On this scheme he forms eight principal classes

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classes or families. viz. 1. Tubulus, or Vermiculus. 2. Cochlidium, or all turbinated Shells. 3. Polythalamia, or chambered Shells. 4. Limpets. 5. Conchæ, or Bivalves. 6. Conchoïdes, or Multivalves. 7. Balanus, and 8. Echinus.

It is evident this method is neither correct or clear, and therefore rather imaginary than useful.

Linnaeus's system places the testaceous animals in his sixth class of Vermes, and begins with the Multivalves, follows with the Bivalves, and ends with the Univalves. He has fourteen families of the turbinated Univalves, and five of the simple, or non-turbinated.

His fourteen families of turbinated Univalves are, 1. The Paper Nautili. 2. The common or chambered Nautili. 3. The Conus or Volutes. 4. The Cypræa or Cowries. 5. The Bulla, in which are the Poached Egg, the Weaver's Shuttle, the
Pewit's

Pewit's Egg, the hump-backed Cowry, vulgarly so called, the Figs, the Turnip, &c.

The sixth family is the *Voluta*, in which not one *Volute*, commonly and properly so called *à volvendo* is inserted; but consists of Midas's Ear, Cylinders, Olives, and their congeners, Tower of Babel, Bishops Mitre, Tiaras, Muffs, and Devils.

Seventh family *Buccinum*, in which are the Helmets, Harps, Persian Conques, and Strombi.

Eighth family Strombi, as Spindles, Spiders, and Winged Shells.

Ninth family the *Murices*.

Tenth family the *Trochi* of all kinds.

Eleventh family the *Turbo*; in this he comprehends all such Shells that run between the *Buccinum* and *Cochlea*, as the
Periwinkle,

winkle, the Ribband Snail, the Serpent's Skin, the Gold and Silver Mouths, the Dolphin, the Wintle Trap, the Grub, and some Strombi.

The Helix, or twelfth family, in which he includes all the horny or semipellucid Univalves that are very thin and brittle ; as the common River Buccina, Pomatia, &c.

The thirteenth family is Nerita : and he places therein only the true Neritæ, as Green Peas, Painted Nerits, Magpies, &c.

The fourteenth family is the Haliotis, or Sea Ears.

The next are the simple, or not turbinated Univalves : as fifteenth, the Patellæ or Limpets, Sixteenth, the Dentalia. Seventeenth, Serpulæ, or Vermiculi. Eighteenth, Teredo, or Ship Worms. And Nineteenth, Sabella, or such whose tubes are made of grains of sand like the caddos worms. , I shall

I shall take more particular notice of these families, when I treat respectively of them in my system or method: and at present shall only make a general remark, viz. that his sixth, seventh, eighth, and twelfth families are very confused. His seventeenth and eighteenth may with propriety be made one family only; and, as for his nineteenth, or Sabellæ, I must needs own, I do not think they can strictly be denominated testaceous, as they are only tubular structures, made up of meer grains of sand united together, like those of the caddos!

This most justly celebrated naturalist, notwithstanding the great adoration paid to him through Europe, I will be bold enough to declare, merits great and severe censure, for changing long-received and authorized names, to others which have as long and constantly conveyed a different received idea or meaning. Thus, the Greek name *Lepas*, always synonymous with the Latin name *Patella*, the latter

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being

signifying little sacrifice-dishes, or saucers, was given to the Limpets, from the earliest Grecian times, and the Roman name from their resemblance to those little dishes; yet, Linnæus wantonly transposes the name of *Lepas* to the *Balani*; multivalves constantly so named from a fancied resemblance they bear to acorns, and thereby not only overthrows custom, but reason; for the similitude to other objects, from which these very bodies received those original names, are by him equally transposed with the very names: for certainly the *Balani*, though they do not very greatly resemble acorns, less resemble platters or saucers. In like manner, the common received name of *Voluta*, from *à volvendo*, or rolled up, which these seem to be, he changes to *Conus*; and claps that very rejected name on another family, wherein he does not place a single shell of that kind, always known and distinguished by the name of *Volutes*, or of a roll structure. And again, family eighth he calls *Strombi*; which contains not one Shell hitherto known by that name; and the very

Strombi, or, as commonly so called, he places in family ninth, which he names Murex.

Such transpositions of names, from one object to another, is not a trivial affair : it creates a vast confusion in science. Names given to bodies that are universally authorized and adopted by custom, though they are not even very apposite or proper, should be kept sacred, and continued without interruption : and when once a body, or set of bodies, have obtained an established or fixed name, certainly no writer whatever, to gratify his pride or his fancy, has a right to transpose it : they only have a right to frame new and correct names, more apposite and scientific, to define such bodies by ; but to transpose names from one to another very different object, is a wantonness can never be justified.

The next author in rank is Mr. Davila. This gentleman arranges his Shells on d'Argenville's system, though not without

making some changes in subdividing, transposing, or joining families together, to give his method more order and connexion. I must own, that in my opinion, Mr. Davila's system will require very little correction.

The last system I shall note is that of Mr. Meuschen, Envoy from several German courts to the Hague. Mr. Meuschen has the three common and general divisions of Univalves, Bivalves, and Multivalves. As I shall have occasion to note his method more particularly in regard to several families, I shall wave saying further of it at present.

Of Mr. Martini's method I cannot say any thing, as the work is not yet completed.

SECTION



SECTION V.

AS the several systems of authors are set forth, I shall gradually proceed on my method or arrangement: however, I will not open the whole at one view, it being my design to detail the several families as I progressively treat on them.

But, before I begin, it is absolutely necessary to fix some essential or standard characters to all Shells; by which they can be divided into families or classes, genera and species. These characters must always be formed from the chief parts of the Shells, the differences of which, in shape, size, situation, or other marks or particularities, will enable us to form respective families or classes, and those families into genera, and afterwards into species, by other subordinate characters. Thus in

H 3

Univalves,

Univalves, let me note the five following standard or essential characters for the classes or families.

These are, 1. Simple or not turbinated. 2. Turbinated, with a single continued cavity. 3. Turbinated and chambered, or with many compartments or cavities. 4. The total shape : and, 5. The aperture, mouth, or opening of the Shell.

The subordinate characters for genera and species, I reckon to be only five for Univalves, viz. 1. The number of spires, convolutions, rounds, or wreaths. 2. Whether operculated, or covered with a lid, or not operculated. 3. The shelly substance, whether opaque, horny, pearly, &c. 4. The Epidermis : and, 5. The head and end or tip.

As these characters include the principal parts of all Univalves, they of course constitute the rudiments of the system.

It is only laudable to collect; but when a collector also makes it his study, to contemplate scientifically the natural curiosities he acquires, he then adds the respect of mankind to the praise already gained by his assiduity.

As on this view I have presumed to trouble the learned with this treatise, which I shall strive to render instructive, as well as merely curious, so far as the subject of Conchology will permit; I think it further necessary to lay down some rules to enable even the collectors as well as the studious, to be aiding or assisting to the study.

Dr. Woodward judiciously observes *, that assuredly, the man who should spend his whole life in amassing together stone, timber, and other materials for building, without ever aiming at the making

* Preface to Catalogue of English fossils, p. xiii.

an use, or raising any fabrick out of them, might well be reputed very fantastick and extravagant. And a like censure would be his due, who should be perpetually heaping up of natural collections, without design of building a structure of philosophy out of them, or advancing some propositions that might turn to the benefit and advantage of the world. This is in reality the true and only proper end of collections, of observations, and natural history : and they are of no manner of use or value without it. Now, as collections are the materials, it behoves every collector to make observations, or give what accounts his capacity or leisure permit him, that others, who shall have more science and leisure to pursue the design, may find land-marks and notices sufficient to conduct themselves by in that so useful a pursuit.

Few Conchologists have duly attended to this view ; and what few curious observations have been made, are scattered or
dispersed

disperſed through many and tedious volumes.

My views being to remedy theſe inattentions, as far as lies in my power ; I ſhall ſtrive to give ſome inſtructions to obtain ſuch ſcientifical ends.

I have always found each ſeparate collection to contain ſome or many ſpecies not met with in others ; and alſo particularities of ſpecies, cauſed either by different growths, accidents, &c. that are inſtructive. A number of ſuch obſervations relative to the ſizes, colours, &c. of one ſpecies, ſelected from different collections, united and collated together, cannot fail to form a conſiderable part of the natural hiſtory of bodies : and ſhould therefore always be attended to, by thoſe that are ſpeculative.

For example, Dr. Liſter ſtiles the Tortoiſe Limpet *ingens*, or of the firſt magnitude ; yet we ſeldom ſee them very large in our collections. The Shells are generally

rally of a middle size, and Rumphius gives them the contour of a rixdollar, or about an inch across. However, the specimens preserved in the British Museum confirm Lister's appellation, and inform us they are to be found from the common size of an inch, and an inch and a half across, to above two inches and a half across. Thus, by the collation of united observations, we always gain additional knowledge, and therefore such enquiries should be assiduously pursued.

In order, therefore, to acquire such illustrations of natural history, it will be necessary to intreat every collector to keep a meer catalogue, if his will or leisure does not prompt him to take further trouble, and only enter the kinds, sizes, and colours of his Shells, whence bought, and other very remarkable particulars. A parcel of such meer notices may be of great use to a man of science, who should happen to peruse them.

This

This procedure would even make fashionable collectors, at the cost of trifling labour to themselves, useful to science.

But for those, whose inclination, abilities, and leisure, prompt them to pursue the study scientifically, the route is to be changed ; their catalogues should be very particular, and attended with descriptions and observations.

As there is a method to be observed in every action of life, I will point out the chief heads, under which to form and digest the said catalogues and observations. First, the family you think it of, of what genus of that family, and of what species of that genus, or if of a new-discovered species, genus, or family. Secondly, if in its rough or native state, note its appearance ; as likewise how it appears when polished, &c. Thirdly, its country, if scarce or plenty, and the soils, or what places of resort it has ; with what other Shells or
fish

fish it is found ; or whatever answerable notices you can procure.

A good description and figure must follow. The description should include all the obvious or visible particulars of the subject ; as size, shape, colour, and other circumstances.

It is a very difficult matter to frame a good or accurate description of a body. That depends on the call of ideas, the force of language, and the choice of comparisons. It behoves me not to explain it further here, as it touches on the science of rhetoric and pure writing. The difficulty of making intelligible and good descriptions has been the rock on which most writers have split.

It is necessary to avoid the affected conciseness and quaint terms now so much in fashion, and only to use the proper language and established terms. Linnæus, otherwise the great ornament of natural historians,

historians, is very blameable in this respect.

To finish this subject, I shall define and name the different parts of Shells, that a proper and distinguished name may be applied to each part: a particular yet much wanted. At the present I will confine myself only to Univalves, leaving the Bivalves and Multivalves to be discussed hereafter. I am the more desirous of fixing technical names, as the unjustifiable and very indecent terms used by Linnæus in his Bivalves may meet their deserved fate, by being exploded with indignation; for

Immodest words admit of no defence,
And want of decency is want of sense.

These my terms being adopted, will render descriptions proper, intelligible, and decent; by which the science may become useful, easy, and adapted to all capacities, and to both sexes.

The

The names I propose for the chief different parts of Univalves are as follow :

1. The Epidermis, or Periosteum. This part is common to Bivalves as well as Univalves. It is a rough covering or skin, which many but not all Shells have, only on the outside, never withinside the Shell. The Epidermis, perhaps, is a perioste or membrane, that covers the Shells to defend them from exterior accidents, to preserve them, and aid their growth. In that it does the same office as the perioste or membrane that covers the bones of other animals : for the Shells of these fish may be considered, and indeed are, as analogous to the bones of other animals. There are many species of Shells constantly have the Epidermis ; and there are others that never have an epidermis, as the Cowries, Olives, &c.

The Epidermis seems as much a genuine covering of the Shell formed by the fish
itself,

itself, as the Shell. And, could we see the recent fish, and examine its organs, I doubt not but we should find the rudiments of a proper apparatus for making the Epidermis as well as the Shell.

The structure of this Epidermis is very different in different genera. In some laminated, in some fibrous and brush-like, &c. It deserves to be more minutely examined, and it seems not improbable but among the several uses of this covering the two following may deserve consideration.

First, to prevent the salt water from corroding the Shell. For all Shells that have the Epidermis have a scabrous surface.

Secondly, to prevent other Shell-fish or marine insects from fixing their habitations on these Shells, as they do upon all bodies in the sea, where there is not a power of defence.

And this makes me imagine that the fish inhabiting all naturally polished Shells
whatever,

whatever, are capable of not only adding to the extent and growth of their Shells; but can likewise, from time to time, add a fresh polished covering to the whole Shell; at least their organs extend to such a length as to clear away all impurities from their Shells. We seldom find any Cowries with Coral or any extraneous bodies adhering to any part of them.

The head (apex) of an Univalve is the part just over the mouth or aperture. The base end or tip, (*basin seu acumen*) that part opposite to it, or the end of the turban, though some authors have given them quite contrary names, by calling the tip or end the part over the mouth. In speaking of Shells it may be understood, that when the upper or under side, or ends are mentioned, it is supposed that the Shell lies on its mouth upon a table, with the head towards the right hand, and the end or tip towards the left.

The

The body of the Shell (corpus) is that part which runs from the top to the extreme limits of the aperture, and may with propriety be also called the first whirl. Plate I. Fig. 3, 4, 6, and 7. *a. a. a. a.*

A whirl, turn, spire, or wreath (Spira, Anfractus) denotes each single or separate turning or circumvolution. See Plate I. Fig. 3, 4. *b. b.*

The disposition of the spires, says Mr. Adanson, p. xxxi. is not the same in all Shells: it varies according to the different plans they turn on, and they can turn on four different plans, which are; 1. the Horizontal Plan; 2. the Cylindrick Plan, or spread on a cylindar; 3. the Conic Plan; and 4. the Ovoid Plan. From these four dispositions of the spires, all the different forms or figures of Shells proceed.

These are the four principal dispositions of the spires ; but there are many intermediate ones, which proceed from different degrees and combinations of these four.

The number and forms of the spires vary in the same species, either in their different growths or sexes. Young Shells have always a less number than the old ones : the reason is plain, as all turbinated or spiral Shells take their growth from the tip or end to the mouth, or upwards. Some Shells, though of the same age, sometimes have not the same number of spires : that is to be attributed to sickness, or rather it is an effect of the sex. Thus, in the *Purpuræ*, the *Buccina*, and in some other kinds, it is common for the males to have their spires less numerous ; more slender and lengthened, or less swelled ; and the whole Shell smaller, than in the females. This observation, which I have not neglected to make whenever opportunity offered, I always found to be constant.

The

The Turban or Clavicle (*Clavicula*) is the aggregate, or whole set of the whirls, and always forms the lower part of the Shell. See Pl. I. fig. 3, 4, and 7. *c. c. c.*

A flat or helix turban (*clavicula helix*) is one so slightly prominent as to be near on a level, as Pl. V. fig. 7, 9. The short turban (*clavicula depressa*) as Pl. V. fig. 3, 4, 8. The produced turban (*clavicula longiore*) as Plate I. fig. 3, 4. Pl. III. fig. 12, 13. Pl. V. fig. 1, 2, &c. The long turban (*clavicula longissima*) as Pl. III. fig. 9. Pl. IV. fig. 4 and 7, are explained by the very names or terms.

The Pillar (*Columella*) is the middle part, or axis, which runs through the Shell its length, or from top to bottom, and from which all the spires commence and turn round, and is the support or basis of them. It always lies aside the mouth, and though not seen in all the Shells, yet in many it is the most obvious part of the mouth, after the lip. See Pl. I. fig. 5. *d. d. d.* I 2 The

The mouth or aperture (apertura) needs no explanation. See Pl. I. fig. 3, 6. *e e*.

A full or round mouth. Plate III. fig. 12.

A fimilunar mouth. Plate III. fig. 14.

The lip (labium) simply, is the meer outer contour of the mouth or aperture; but the inner, or columella lip, (labium interius vel columellæ) is the polished or smooth part opposite to the lip, and is always spread on the columella. See Pl. I. fig. 3, 6. *ff. g g*.

The beak (rostrum) is that prolonged furrowed part, extended streight upwards from the top of the aperture like a horn, more or less in the different families. It is by some authors called the tongue or bore, especially when spoken of the *Purpuræ*: as it is imagined they bore the Shells of the fish they feed on, with it. See Pl. I. fig.

fig. 3, 4, 5, 6, 7. *h h h h h*; also Pl. IV.
fig. 4 and 5.

The scoop (sinus) is the hollowed or gutter-like process placed side-ways of the beak, and lower down on the very lip; which is seen in the spiders, &c. Such Shells have been called, from these two-fold processes, the beak and this, *Buccina Bilinguia*. See Pl. I. fig. 6, 7. *i i*.

The claws or prongs (*digiti, dactyli, unguli vel appendices*) are the processes that issue from all the contour of the lip, as in the spiders. See Pl. I. fig. 6, 7. *k k*.

Umbilicated Shells (*Cochleæ Umbilicatæ*) are those that have a navel or hollow placed on the first or body whirl, or in the center, which penetrates the Shell deeply, or its length. This is mostly seen in *Cochleæ, Trochi*, and some *Buccina*. See Pl. III. fig. 11. Pl. IV. fig. 6.

Helices (Helices) are those Shells that have their whirls or turnings lying, as it were, between two flats or levels, as some river snails, post-horn snails, ammonitæ, and others. See Pl. II. fig. 19, 22. Pl. III. fig. 10.

Revolved Shells (*univalvia turbinata, clavicula intus recondita, vel ita in se con-torta, ut eorum circumvolutiones nulla ex parte promineant*) are those that turn or revolve withinside, or whose whirls or turnings are hidden or absorbed within the body of the Shell, so that only the outer whirl is seen, and they have no clavicle; such are the Nautili and the Cowries. See Pl. II. fig. 16. Pl. III. fig. 1, 2, 3, 4, 5.

Winged Shells (*Alatæ*) are those whose lips expand greatly outwards, and form large flaps or wings; as the Plough, the Duck's Wing, the Spiders, and many others. See Pl. I. fig. 6, 7, and Pl. V. fig. 1.

Right-

Right-handed Shells (*heterostropha*) are such whose whirls, or convolutions, turn from right to left, or contrary to the most general manner of turbinated Univalves.

Operculated Shells (*cochleæ operculatæ*) are such as have a loose piece, which shuts up or covers the aperture or mouth of the Shell, like a lid. So that the Shell really consists of two separate and very unequal pieces, viz. one piece flat and small, the other large and spiral: the former being the lid, the latter the Shell itself. None but turbinated Univalves have opercula or lids.

These opercula, or lids, see Pl. I. fig. 10. are small, in comparison to the Shells: and of different substances, as shelly, leathery, or horny. They are also of different forms, as perfectly round, simular, elliptical, oval, or very lengthened: and they are generally

I 4

wrought

wrought with a spiral work, or with concentric circles.

The operculum, or lid, is always fixed on the upper part of the pedestal of the fish. In some at the outer end or extremity, so that it retires considerably from the Shell when the animal moves or walks. In others it is placed at the inner extremity or root. The operculum exactly covers or closes the Shell in those whose mouths are round, semicircular, or oval, as the Nerits, Pl. III. fig. 14. Turbines, Pl. III, fig. 12. Purpuræ, Pl. IV. fig. 4, and 5, &c.; but in those Shells that have very lengthened or narrow mouths, as the Volutes, Pl. V. fig. 8 and 9, it is not easy to conceive what use the opercula are of; for they seem not to shut or cover much above the fifth part of the mouth*.

The

* Surely all the Operculæ serve as covers, and entirely shut up the fish; therefore, though they do not seem

The above is meant only for Sea Univalves, whose opercula are a part of the animal, and is brought forth with it. The operculated Land Univalves are very different; they form a new lid or operculum every year, or oftner; and that is only at such times that the animals want to shelter themselves from the injuries of the weather. It is composed of a viscus flabber, from the body of the animal, which condenses into a kind of toughish coriaceous or leather-like substance, and is pretty thick. This lid or crust is never attached to the body of the animal, as in the Sea Univalves, but merely covers the mouth; nor is it ever wrought with a spiral or with concentric circles, or indeed any other regular work.

seem to fit the outer mouths or apertures of the Shells, yet the fish retires within the Shell, so far as to make it fit, or close exactly to where he retires.

All

All shell-like opercula are of a calcareous nature, and dissolve in acids. It is therefore, that when put in vinegar or other acids, they move briskly to and fro for some time, by the ebullition; from which particular, among the common people fond of curiosities, they have obtained the name of *Creeping Stones*. The horny and leathery opercula spurn acids. They have a kind of greasiness or unctuousity, which, when they are burnt, exhales a strong smell, sometimes agreeable, but most generally very foetid. The *Blatta Byzantia*, *Conchylium*, or *Unguis Aromaticus* of the ancients, and greatly valued, till of late, in the materia medica, was of this latter kind. It was called *Unguis*, because imagined to resemble the talons of a bird of prey. Dioscorides proposes two kinds; one from the Red Sea, white and greasy, which was the most esteemed: the other black and not so large, which came from Babylon. Of later times they have used indifferently the small round opercula of
Purpuræ,

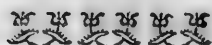
Purpuræ, &c. by the name of *Blatta Byzantia*. When burnt they exhale a smell somewhat like that of *Castoreum*, and their smoak was held good for vapours and the epilepsy, and in decoctions they were reckoned laxatives: but at present these medicines are exploded.

Simple Univalves (*Univalvia non turbinata, vel in se non contorta*) as the Limpet, Pl. I. fig. 1 and 2, the eye or apex. 4.

Chambered Univalves, (*Univalvia Polythalamia*) as the Ammonite, &c. Pl. II. fig. 12, 14, 17, 20, and 21.

Revolved Univalves. See p. 118.

Turbinated Univalves, (*Univalvia turbinata.*) See Pl. I. fig. 3, 4, 6, 7.



SECTION VI.

AS I have now finished the general parts of the study, I shall regularly proceed to my system or method of Shells; but, previous to it, must make some observations.

First, I do not think it necessary to divide Shells, as Lister, Gualtieri, Argenville, and others have done, into land, river, and sea Shells. I really do not find essential characters enough between those Shells to positively or definitely determine which are which. Some have pretended to establish a character between them, from the extreme thinness of land and river Shells to sea Shells; and the want of colour in the land and river Shells. But they are no fixed characters; for numbers of sea Shells are

as

as thin as river Shells, *e. g.* the Paper Nautili, Partridges, &c. Mr. Davila has on this error placed the small blue rayed, and the cracked Limpets, as river Shells, which are sea Shells.

In regard to land Snails, many of them are as thick and well coloured as any sea Shells; therefore this character is also very vague and uncertain.

However, one character is very fixed, or a standard in the land operculated Univalves, and is extremely different from the sea operculated Shells. I took notice of it in my account of the opercula or lids. It is, the opercula, or lids, of all Land Shells, are never wrought with spiral lines, are of a tough or leathery substance, and not stoney or cartilaginous; and besides, they are never attached to, or make any part of the very animal. It is extremely seldom that we can elucidate this particular in collections; as Shells and their opercula are rarely seen together.

gether, therefore it is from the result of observations only I assert it. However, any land Snail will demonstrate it; which, if we did not know was a land Snail, we might positively affirm to be one from its operculum or lid; for it is leathery, has no concentric or spiral lines, and is spread over the mouth in such a manner, as even to pass over the very edges or contour: whereas, on the contrary, a Bloody Tooth, Nerit, or any Buccinum, can be proved to be sea Shells, by their opercula being shelly, by the work on them, and also by being closed within the lips or edges of the aperture, and not spread over them.

These reasons make me reject, in my system, the division of Shells into land, river, and sea; because, for want of common fixed characters, we never can positively ascertain which are which. I therefore shall blend all Shells together without such distinctions.

A se-

A second observation I shall make is, that the most general structure of testaceous animals is to be attached to their Shells, and to be always fixed in them by one or more ligaments or muscles. This fixation certainly answers to reason ; for these creatures can never probably be imagined to form their Shells, and augment them when necessary, had not the animal itself a fixed and common communication with its Shell, by means of muscles, to transmit the proper juices for the increase of it. Yet, however, it is averred, that the fish of three families are not always affixed by muscles to their Shells, and those are the Vermiculi, the Dentalia, and the Paper Nautili.

The Paper Nautilus appears not to be fixed by any one part to its Shell, and is very frequently seen without it. The fishermen must be very nimble to catch the fish in its shell, they quit their Shells with such ease.

case. The Vermiculi and Dentalia are found floating, as it were; in their Shells, no ways fixed, but quite loose and free, like any thing in a sheath. However, to reconcile this seeming paradox, and perhaps it is the real state of the case ; it is more reasonable to advance, that these animals are absolutely loose from their Shells, but rather that they are only very slightly connected to it : and, perhaps, when the Shell is complete or full grown, they detach themselves from the muscles. Analogous to what lobsters and other crustaceous fish do when they cast their yearly crusts ; that is, they detach the muscles of the old crusts, to affix them on their new ones.

There is another observation to be made with regard to Vermiculi, viz. that these testaceous animals border on, or connect so close to, all the coral Polypes, that it is impossible to fix their distinct limits, so as to pronounce definitively whether Corals
should

should be ranked as testaceous animals, as a late author, Martini, has done in some particulars ; or, whether the Vermiculi should rather be ranked as Corals, and expunged the Testacea. I must needs own I waver so much in my opinion, as not to be able to determine it at present ; therefore, shall leave it to be settled by future naturalists. However, I am of the celebrated Linnæus's opinion, to separate them, and make the Vermiculi and Dentalia testaceous animals, and the Corals a quite separate or distinct order.

Another particular is also to be settled in regard to the Echini. The Echini are as yet very indefinitely placed by naturalists ; many ranking them as crustaceous, many as testaceous, and even many as animals of an order distinct from either. Thus Lister and Adanson take no notice of them among the Testacea. Rumphius and Seba place them with the Sea Stars and Crustacea. Linnæus calls them Mollusca, as he does

Sea Stars, &c. and distinct from Shells, while, on the other hand, Buonanni and Grew, who rank them with the Testacea, place them as Univalves ; and Woodward, Argenville, Gualtieri, Breynius, Davila and Meuschen, all rank them as Multivalves.

I shall therefore give my opinion of the rank of these animals as follows, viz. that though the Echini, by being a lump of naked flesh, merely included or lodged in the Shell, brings them to my definition of Testacea, and not of Crustacea ; yet the two orifices in the very shell for their food and excrements, their spines and progressive motion thereby, and their crusts similar to that of Crustacea, approach them so near to it, that I am led to reject them from the order of testaceous animals : nor can they be properly arranged as crustacea. Therefore, I would propose to range them in an order by themselves.

Those

Those recited authors who have ranged them as Shells, place them as Univalves, or as Multivalves. The latter disposition is certainly very erroneous ; for, though they define the many futures seen in Echini as so many valves, yet they cannot in anywise be reckoned as such, for they have no play or motion whatever, as valves, but are meer joinings of several pieces, always permanent and fixed. Neither indeed would the name of Multivalves answer to all Echini, could the futures even be termed valves ; as only some genera, not all Echini, are composed of such futures.

As for making them a genus of Mollusca, with the Sea Stars, &c. as Linnæus does, I can in no wise approve it ; because, certainly, the Sea Stars being coriaceous, and the Echini crusty, they demand different orders, for they cannot be reckoned genera of the same order. It is, therefore,

I think myself further justified in creating a new order*.

Now to the system or method.

I divide all testaceous animals into the three usual general divisions of Univalves, Bivalves, and Multivalves.

Each of these three general divisions contains many families, genera, and species.

Mr. Tournefort well observes, there ought to be certain principles or characters in

* The numerous class of Echini most certainly are crustaceous, are conjoined to the Star fish, or at least are *Affines*. They have no common character with the Testacea, but their living in the sea, and partaking of the nature of marine animals. It is not clear, that they do not in certain periods even change their Shells, as crabs and lobsters. How else can we account for their increase? The form and substance of these Shells render it extremely difficult to account for this, without such a supposition — they are neither Univalves nor Multivalves. They are a class apart, as much as the Astaci, &c.

Some of the Sea Stars consist of many crustaceous parts; their food, their progression are, similar, and must be conjoined. Corio-crustacea.

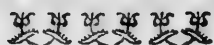
every system or method; which principles or characters should always be taken from the chief part of the objects, and not from several parts. This character should also be the constant one through the whole system, to preserve a perfect regularity. Thus all bodies which agree in one fixed character form the class, and the affinities or differences of those bodies to each other in other less chief or principal parts, create the subordinate genera and species.

On this maxim I shall build my system, and for all the turbinated Univalves, I shall fix on the aperture or mouth of the Shell as the head or chief character. For the Bivalves on the hinges, and for the Multivalves, on the number of valves.

The simple figure, the-chambered structure, and the latent whirls of the revolved Shells, which are all the remaining Univalves that are not characterised by the mouth, such as the Limpets, Ammonia, and

Cowries, shall be the head characters for those families.

In regard to secondary or subordinate characters for genera or species, I shall note the following : 1. The figure or shape. 2. The turban or clavicle. 3. The work on the Shell : and, 4. The other less essential particularities ; as, thickness or thinness of the Shell, the epidermis, and the substance, whether pearly, horny, or opaque, &c.



SECTION VII.

THERE is one natural order of univalve Shells, which ought to be adhered to as scrupulously as possible. One should proceed from the simplest forms to the most complex.

The Patellæ undoubtedly stand first.

The Aures Marinæ.

Cowries.

Olives.

Volutes.

Nerits.

Globosæ.

Cassides.

Trochi.

Cochleæ.

Turbines.

Buccina.

Murices.

It will be difficult to fix the limits where one class ends, and another begins. But, by keeping close in view the natural procession, it seems practicable to form a better system than any yet proposed.

The enumeration of the Univalves is as follows :

Division I. Univalves.

Part I. Simple Univalves, or Univalves not turbinated, or little, if at all, spiral. This part contains four families : viz. 1. The Limpets. 2. The Aures Marinæ, which are slightly spiral. 3. The Vermiculi or Worm Shells : and, 4. The Dentalia.

Family 1. Limpets. Patellæ.

This family derives its Latin name from its resemblance to a little plate ; like this utensil, the Limpets are for the most part round, or oval, or approaching thereto ;
the

the part that contains the fish is concave, smooth, and often finely washed with colours. The Shell is more or less conical. The apex, or eye, is either whole or perforated, and is seldom placed exactly in the middle of the Shell, but most commonly inclines towards one end; that is, taking it in its longest dimensions. The rim of the Shell, which forms its base, is likewise various, sometimes without any prominencies or smooth, sometimes with large ones or jagged, and sometimes with flits only, or crenated. Their external surface is often rough and scabrous, and their apices often imperfect; for, most of this family adhering to the rocks, they are much exposed to the sun during ebb, and to all the violences that render dead Shells unacceptable to the curious.

Though it commonly happens, that the Shells most remarkable for the brilliancy of their colours are of the simplest form, as the Nerits, Olives, Volutes, &c. yet this tribe seems an exception. It is true there

there are considerable numbers that have very lively colours; yet, in general, they abound with less variety than most other Shells. In some parts of England the Limpets have obtained the name of *Nipple Shells*.

The Limpets from particular characters may be divided into three genera, viz.

1. Whole or entire Limpets (*Patellæ vertice integro*), or that are not perforated or open at top.

2. Chambered Limpets (*Patellæ conca-meratæ five cavitate Stylo interno donata.*)

3. Pierced or perforated Limpets, Masks, (*Patellæ vertice perforato*) or those that have their tops perforated with a hole pierced quite through the Shell.

Some authors have made a fourth genus of Limpets, with a twirled, crooked, or produced beak. (*Vertice adunco*) But as several Limpets run much on it, though
not

not properly twirled or produced, when their beaks are pointed and situated sideways*, I cannot think it a character sufficient or strong enough to form a genus.

I have already observed, that in the vast volume of Seba, it is very remarkable, not a single Limpet is figured, described, or even mentioned.

The Limpets, though not seemingly so, are a numerous family. I have recognized about seventy species.

The first genus, or whole Limpets, is very numerous. The second, or Chambered Limpets, has many species : but the third genus, or perforated Limpets, or Masks, has but few species. The enumeration of all the species appertains more properly to a history of Shells, than to these rudiments.

* Concho-lepas, Cochlea-lepas, &c.

Europe affords few species. The finest and largest are from the East-Indies. Africa, especially the Cape of Good Hope, produces many fine ones. America has many of the chambered and smaller kinds : and late discoveries have brought us some large and fine Limpets from the Streights of Magellan and the South Sea.

Plate I. fig. 1, 2, represents the common English Limpet in two views.

Plate II. fig. 1. The Goat's Eye Limpet. *Oeil de bouc*, Argenville, p. 188. Plate II. B. Gualtieri. Tab. 9. H. A Mediterranean Shell.

Plate II. fig. 2. A Chambered Limpet from America in two views.

Plate II. fig. 3. The Magellanic Mask Limpet.

These

These are the necessary notices that occur to me relative to the recent Limpets, or those known from sea. But, as appendices to the several families of recent Shells, I shall enumerate some fossil Shells which are not yet, to my knowledge, discovered or known recent or living, in order to form a more complete system of testaceous animals than has hitherto been done : by interpolating the unknown fossil Shells with the recent ones. For not only single species of fossil Shells yet remain undiscovered in their recent or living state ; but genera, and even whole families, as the Ammonia, Anomia, &c. by which means I add those Desiderata which we are sure still exist in the seas, though not yet known to us otherwise than in the fossil state.

Fossil Limpets are very rarely met with ; however, there are two kinds which seem to challenge a place in this appendix, viz.

A small

A small species of Fools Cap. It seems different from the West Indian kind, but approaches it nearly. This is not unfrequently found in the calcareous soils of France.

The second is a very curious and remarkable kind, and the fragments of it, called by fossilogists Trichites, are found in great abundance in the English chalk-pits*, yet the Shells are so excessive rare to be met with entire, or even nearly so, that I have never seen but four, which are all in the elegant collection of my esteemed friend Mr. Ingham Foster, of London, who found them in the chalk-cliffs near Dover.

These Limpets are very large, and, like the Concho Lepas, resemble a single Shell

* *Trichites Cretaceorum*, *Lhwydii*, *Lith. Brit. Ichnogr.*
Nos 1751 & 1752.

of a Bivalve. They seem to be of two kinds, and are more irregular than that Shell, and, instead of being fulcated lengthwise, are circularly wrought, or in a transverse manner, with very high irregular ridges, not thickly, but rather thinly set. The Shells are very thick. One sort is high, or copped, the other is broad or flattish. The inside is quite smooth, the edges turn outwards, and, under the beak, or that part which answers to the hinge in Bivalves, they stretch out (all towards the same side) into a broad flat ledge, the perpendicular side of which, is curiously worked with straight and parallel furrows, like to the hinge of a Multarticulate Bivalve. On the very top or beak part, it has a large, wide, roundish opening, like a fracture, which, from its remarkable thinness, makes it difficult to determine, whether it be a natural perforation or an accidental fracture, though, by its regular edge, and being quite alike in all the four specimens, one would incline in favour of the former.

Family

Family 2. *Haliotis**, *Aures Marinæ*, Sea Ears. The definition of this family is as follows: Shells of an ear-like form, flattish, almost wide open, or hollow, for, from the apex or head, all along one side, it has only a broad ledge or margin. The apex has also a single perfect whirl, and a curved row of holes, or perforations, runs its length, from the head to the opposite end.

These Shells, in appearance and nature, approach so extremely to the Limpets, for they also fix themselves to rocks, that I think they justly demand the next place or link in the method.

* *Haliotis*. Lister could have had no doubts about this family being next in order to the Limpets, had he observed, the natural method, i. e. simplicity of figure. It is true this Shell has a whirl (rather than a spire); but in some species it scarcely projects. One sees, in many of the Nerits, very evident tokens of more circumgyrations.

However,

However, they cannot be properly called simple, or Shells that are noways spiral ; because at their head they have as perfect and fine a whirl as any other turbinated Shell: but, as Nature in her works has made such slight transitions from one family to another, it is impossible to fix them by human definitions. Thus several of the Chambered Limpets have such single whirls, and the *Trocho Lepas* and *Cochlea Lepas* are even so greatly spiral, as exteriorly to resemble a *Trochus* or a *Snail*; yet are they true Limpets. It is therefore impossible to regulate natural objects to a perfect precision, by the most elaborate and minute definitions.

This spiral head of the *Haliotis* has made some authors not only separate them from the Limpets, but also even reject them from the simple Shells. Thus Lister * places them in his *Historia Con-*

* See the note which is printed in p. 144.

chylorum among the turbinated Shells, after the Nautili, the Snails, and the Nerits, and preceding the Trochi. He does the same in his work de Animalibus Angliæ, wherein, p. 167, he says, it is spiral at the Clavicle in the same manner as other turbinated Shells, and therefore by some is wrongly placed among the simple Shells. Gualtieri ranks them among the Snails with depressed or flattened clavicles; and Adanson and Meuschen take them from the simple Shells, and place them as the first family of the spiral Shells.

I shall fix another character to this family, in which all other authors, Linnæus excepted, differ from me : that is, I can allow no Shell to be of the Haliotis family without having the row of perforations ; for I hold that to be an essential character. Thus the Venus Ear, ranked as a Haliotis, I shall, like Linnæus*, separate from them.

* Syst. Nat. p. 1250, 713, Helix Haliotoidea.

There is yet another character, which seems to belong to this family ; that is, their inside is always of the finest or most orient pearl ; and even pearls are often bred in them. This is also another reason why I do not allow the abovesaid Venus Ear to be of the family, for it wants the pearly inside, as well as the perforations.

In the row of holes, or perforations, there are generally six or seven quite perforated, or very open ; the rest are closed, and appear rather like tubercles than holes ; for it is said the fish always closes one towards the head, and opens another towards the end, as he grows bigger, and by these holes he flings his excrements forth from his Shell.

There are very few species of this family. It is even doubted, whether some species proposed by authors, are not rather varieties : but they are found in great abundance in most parts of the world.

I never knew a single instance of a Haliotis being found fossil. Pl. II. fig. 4, represents a Haliotis or Sea Ear.

The third family is the Vermiculi, or Worm Shells. The definition of this family is, tubular cylindrical Shells, single, in masses together, or adherent to other Shells or bodies. Variously sinuous, by winding or twisting to and fro in a very irregular manner. The Vermiculi in general are of no determinate or fixed regular shape, from their windings and twistings. But as there are some species which either wholly, or in particular parts, have a regular form; and others which have a kind of concame-rated structure; and in that only differ from the generality of them, as the Wattring-pot, and the Chambered Worms; I shall constitute a particular genus for them. Thus the Vermiculi will range under two genera, viz.

1. Ver-

1. Vermiculi, or tubular Worm Shells, which have no fixed or regular form, as the common Vermiculi.

2. Penecilli, or those other Worm Shells which in the whole or any especial or particular part, have a determinate regular shape or structure,

I have already hinted the near approach of these Shells and their animals to corals; but that I should keep them separate, and as testacea. However, I shall reject all the Sea Worms which inhabit tubes made up of grains of sand and other substances, connected or joined together by a glutinous matter; for they are not a structure of a solid testaceous substance, and therefore cannot be reckoned as Testacea: such as the Sabellæ Linnæi *.

* Syft. Nat. 1268. 335.

The first genus of Vermiculi, though found every where in great abundance, are not of many different species.

Vermiculi, in their various windings, are sometimes so regularly spiral, as to emulate the most perfect turbinated Shells; but that is only accidental. Pl. II. fig. 6, a groupe of small Vermiculi Shells, and a single large one somewhat spiral.

The second genus, which I call Pencilli, are Worm Shells, of a regular determinate figure in the whole, or some particular part, or else of a particular structure,

There are few species of this genus. The Watering-pot, Pl. II. fig. 8. * from the East Indies, is the chief kind, and, when perfect, is much valued.

* *Serpula Penis*, Linnæi Syst. Nat. p. 1267. 806.

Gualtieri ranks the famous Shell the Wentletrap, or Stair-case*, with Vermiculi: he gives for reason, that the spires of this Shell are meer loose ones, not produced from, or any-ways connected or supported by, a pillar or columella, running through the middle of the Shell, its length, as is the constant and true structure of all turbinated Shells. If so, they certainly are not Buccina, as most authors rank them, but Vermiculi. Davila also places it among his Vermiculares, without giving any reason for so doing.

There are also Vermiculi, which have concamerations, or are divided into chambers by a few or many transverse plates, Pl. II. fig. 5 †, but they are seldom regular, or set at equidistant intervals, and are not pierced by a pipe or siphunculus, that communicates from chamber to chamber, so as to permit the fish to penetrate more than one chamber or inclosure at a time, in which

* Turbo Scalaris, Linnæi Syst. Nat. p. 1237. 630.

† Serpula Polythalamia, Linn. p. 1266. 802.

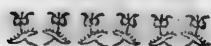
particulars they essentially differ from the concamerated Shells, as the Nautili, &c. Besides, these concamerations do not seem constant to any particular species, and appear rather the closing up, and deserting the old place of habitation of the fish, when it augments its Shell; like as the very bottom spires of a turbinated Shell, which the animal fills up as it grows bigger, and enlarges its habitations. The *Solen Arenarius* of Rumphius, Tab. 41. fig. E; and those of Davila, Tab. 21; which latter author classes them among his multivalves, are of this kind.

The *Vermiculi* are frequently found in the fossil state; but I do not recollect any species, but what is known recent, or from Sea.

The last and fourth family of simple Shells, or not spiral, is the *Dentalia*. The definition of this family is, Simple tubular Shells, of a regular, determinate, curved, conical shape, and open at both ends.

This

This family has very few species : and the fossil ones afford not any kinds yet undiscovered recent. Pl. II. fig. 9, the large green furrowed Dentale of the East-Indies. Pl. II. fig. 10, the smooth yellowish Dentale of the English sea.



SECTION VIII.

DIVISION I, Univalves, part 2.
 concamerated or chambered Univalves, that have many regular and near equidistant cells or chambers, and a pipe or siphunculus, that opens into, and communicates from chamber to chamber.

This chambered structure, I fix as the essential and specific character of the Shells of this second part of the first division; for there occur among them not only revolved and turbinated Shells, but even quite simple or no-wise turbinated ones.

This second part contains six genera, one genus whereof, viz. the Orthoceratites, is of a simple figure; four genera, as the Lituitæ, or Croziers, Polythalami, Turbines Ammonia and Ammonoides, are all turbinated; and the other genus, or Nautilus, is revolved.

(*addc. Corr. p. vi.*)

I

For

For the arrangement of these chambered Shells, we must have recourse to the fossil kingdom; since there are only two genera of the fix, viz. the Lituities and Nautilus, that are known recent or from sea. Consequently the fossil kingdom alone helps us to arrange four whole genera, and many species of the two other genera in the system of Shells, all which yet remain undiscovered living or recent from sea.

In my twenty-fifth lecture, on fossils, I have treated this subject fully; and have observed how surprizing it is, that these genera, which are found fossil in such amazing abundance, all over the globe, and besides are numerous families, have to this hour escaped the researches of mankind, to discover them recent or living. Besides other arguments given, their being Pelagian Shells, or Shells that inhabit the very deepest recesses of the sea, seems one principal cause; as those deep recesses are not subject to the agitations of the great tempests

pests and other violent ragings of that immense mass of waters; and therefore the Shells constantly remain undisturbed in them.

Genus 1. *Orthoceros*, simple straight conical Shells, or no-wise turbinated; and gradually tapering from a broad end to a sharp-pointed top, like a strait horn, whence their name. They are chambered from bottom to top, and have a siphunculus, or pipe of communication, from chamber to chamber. Pl. II. fig. 12. is greatly magnified, fig. 13. being the natural size of the Shell discovered, — taken from Gualtieri.

Pl. II. fig. 14, is a fragment of a fossil, orthoceratites, in a small scale, taken from Breynius de polythalamiis; *a a a a*, the cells or chambers; *b b b b*, the siphunculus, or pipe of communication, which in both these figures is central.

Plancus

Plancus in his book de Conchis minus notis littoris Ariminensis, describes some recent minute kinds of this genus, which he found in great quantities in the sea sediment, at Rimini in Italy. The Orthoceroſes he diſcovered were ſpecies ſo very minute, leſs than one quarter of an inch, and not thicker than a pin, that they demanded the aid of the microſcope, to diſcern their ſtructure. Gualtieri, Tab. 19, has figured four kinds of them, ſent him by Plancus; and Linnæus ranks them in his ſyſtem, as Nautili *.

How different theſe are from thoſe found foſſil, is extremely ſtriking; the recent ſpecies are ſo very minute, as to demand the microſcope to view them; the foſſil ones, on the contrary, are moſtly very large, frequently above a foot in length, and above an inch and a half over, even the ſmalleſt kinds; as the Alveoli are ſeldom leſs than an

* Nautilus Orthocera, Linnæi, Syſt. Nat. p. 1164. 289.

inch long, and a quarter of an inch over: and besides their great difference in size, they no wise tally in other particulars with the larger, so as to be imagined young ones of the same species.

Breynius, who first formed this genus in his work de Polythalamis, proposes nine kinds; and I have observed some others not mentioned by him.

I would divide this genus into two sections, viz. 1st. those that have the siphunculus placed on or near the edge; and 2dly, those that have it central, or near the center.

It is proper to observe, that these fossils are always casts of stone or replacements of sparry matter. I have however seen, though extreme rarely, slight fragments of the shell on them, which fragments were whitish and very thin.

Genus 2. *Lituus*, the crozier. This Shell exactly resembles a Bishop's crozier in shape, for it has a long cylindrick stem, one end whereof turns in a spiral manner; but the spires are few, separated, and recede from each other.

Breynius, who first formed this genus, in his above quoted work, describes and figures a single species, so that it is an extremely rare fossil. But there is a species of small recent Shell, commonly called the *rams horn**, found in great abundance, both in the East and West Indies, which is ranked by most authors as a *nautilus* or *ammonis*, that certainly is the very identical species with the fossil kind. We only see the spiral end of this recent species in our collections, and never with its stem. However, the view alone of it

* *Nautilus exiguus, albus, pellucidus, teres*, Liff. Hist. Conch. lib. 4. Sect. 401. fig. 2. *Nautilus Spirula Linnæi* Syst. Nat. p. 1163. 279.

evinces its analogy ; for as the spires are few, and greatly recede from each other, it must follow that the outer spire will at last insensibly fall into a strait line or a stem : and the reason we never find it with the stem, probably, is owing to the thinness and brittleness of the Shell ; so that the agitation of the waves, for it is only found cast up on the shores, easily breaks off this stem or cylindric part. Pl. II. fig. 18. is the entire Shell and fig. 19. is cut open, to shew its chambered structure.

Genus 3. Turbo Polythalamus five Concameratus. I am the first who has proposed this Genus. It is only found fossil ; and even in that state but one species is known to me. It is a turbinated or spiral Shell, of a produced or lengthened shape, exactly like a Buccinum in appearance, but is concamerated or chambered, and the diaphragms or partitions are cut and jagged, like to the foliaceous futures of the Ammonia.

Cast

S E C T I O N VIII. 161

Cast of stone of this kind, for I have never seen it in the Shell state, are found in Dorsetshire, France, and Switzerland, but never in any great degree of perfection.

Pl. II. fig. 11, is a Turbo Polythalamus, but by the mistake of the engraver, the figure is laid flat; whereas it should have been erect, in the same manner as a Whelk, or other turbinated Shell.

Genus 4. Cornua Ammonis, or Ammonia. The Shells of this genus are perfect Helices, the spires lying between two flats or levels. Pl. II. fig. 20, is an Ammonis, and fig. 21, is cut or opened, to shew its several cells or chambers.

The spires are cylindric, and connected to each other. They gradually diminish or taper (on both levels equally alike) from the circumference to the center; so that by the gradual tapering of the spires to the center, the centers of both flats are concaves.

M

The

The inner structure is chambered ; but the diaphragms, or partitions of the cells or chambers, are not roundish and with an even edge, as those of the *Orthoceros* and *Nautilus*, but are flaked, or jagged, into processes or appendages, which laid together tally and close into one another so strongly and curiously, that, when joined, the flats or surfaces of the whole *Ammonis* are embellished with a beautiful leaved work, exactly similar to that on the sculls of animals : and this by fossilogists is called the foliaceous futures of the *Ammonites*.

However, this foliaceous work does not seem to be a particular character of the *Ammonia*, for the *Turbines Concamerati*, or preceding Genus, have it ; and I have likewise seen species of *Orthoceratitæ* and fossil *Nautili* with the same work.

The

The siphunculus, or pipe of communication from chamber to chamber in the Ammonia, seems to be placed on the back of the spires, and not near the edges or in the center of them; but, as I can only draw this conclusion from fossil ones, which are very rarely so perfect as to shew the pipe distinctly, we must yet remain uncertain in regard to this and some others of their particular characters.

It is a matter of astonishment in this and other families of testacea, that in general the most common fossil Shells are the scarcest in the recent state, and *vice versa*. It could be readily explained, were all the fossil kinds, not known recent, reckoned Pelagian Shells, as the Ammonia certainly are: but then what reason can be given for the Limpets, Sea Ears, Volutes, Cowries, &c. which, though in extreme plenty recent, are very rarely

found fossil, with many other such parallel instances.

The fossil *Ammonia*, or *Ammonitæ*, are found in great abundance, and of many species, in most parts of the world; from the small size of a pea, through all the gradations of sizes, to above a yard in diameter, and proportionably thick. These are not objects that escape the eye by their minuteness; yet, nevertheless, all the species of them still remain to be discovered, except one very minute kind.

This discovered living species of *Ammonis* is so very minute, as hardly to exceed the bigness of a turnep seed, and does not weigh the hundredth part of a grain; therefore demands the aid of the microscope to view it. It was found by Planus with the recent *Orthoceroses* above-mentioned in the sea sediment at Rimini: he has described and figured it in his
work.

work. Gualtieri has also figured it as magnified by the microscope in Tab. 19. fig. H. I. and Linnæus ranks it among the Nautili.

It is very remarkable, that this recent species is a distinct kind from any of the fossil ones known. It not only differs in particular circumstances, but even in an essential character ; which is, that as all the fossil ones, or Ammonitæ, have a concave center, this recent kind has a very prominent or projecting one.

By what general observations I have made on the Ammonitæ, I think the specific character for their sections, or arrangements, is to be taken from the work on the back of their spires ; for it is the most obvious, constant, regular, and certain character.

On this character I shall divide the Ammonia into eight sections or arrangements.

I have given a full account of the sections, and the species that rank under them, in my twenty-fifth lecture on fossils ; which I shall here briefly recapitulate.

Section I. Ammonia, whose backs are quite smooth and plain : *Ammonia dorso lævi*.

Section II. Ammonia, whose backs are striated, fulcated, or ribbed : *Ammonia dorso striato, fulcato, vel costato*.

Section III. Ammonia that have a plain prominent ridge along the back : *Ammonia limbo prominulo per totum dorsum ducto*.

Section IV. Ammonia with a plain prominent ridge between two furrows : *Ammonia limbo prominulo inter duo sfulcos erecto*.

Section

Section V. Ammonia with a prominent ridge, not plain as in Section III. but wreathed or twisted like a rope : *Ammonia limbo tæniolato*.

Section VI. Ammonia with a plain furrow or channel along the back : *Ammonia fulco unico per dorsum ducto*.

Section VII. Ammonia whose backs are studded or spiked : *Ammonia dorso tuberculato vel aculeato*.

Section VIII. Ammonia whose backs are deeply notched or toothed like a saw : *Ammonia dorso dentato*.

Genus 5. *Ammonoides*. The definition of this genus is, that, in all other respects except shape, it resembles the *Ammonitæ*; for these bodies are quite globose like *Nautili*, and not flat like *Ammonitæ*. The outer spire alone makes above one half of

the body; and all the other spires are very small, and taper into a concavity, so that the center is deeply hollowed or umbilicated. Pl. II. fig. 15, an Ammonoides. These elegant fossils are found at Draycot in Wiltshire, and in Switzerland.

Genus 6. Nautilus. The Nautili I define to be revolved Shells, or such whose spires never appear externally, but lie latent or quite hidden within the body of the Shell. Turbinata, volutæ apice non emimente : vel clavicula intus recondita.

The Nautili are of a chambered structure; the partitions of the cells or chambers being concavo-convex roundish plates. However, I have seen fossil kinds with foliaceous futures like the Ammonitæ; which implies, that all the species have not such regular roundish partitions: and, indeed, Breynius solely, on this account, divides the Nautili into two orders, of those with concavo-convex semilunar diaphragms, and those with jagged or sinuated diaphragms.

Pl. II.

Pl. II. fig. 16. the Indian pearly Nautilus.
Fig. 17. the same Shell laid open, to shew
its cells or chambers, and its siphunculus
or pipe of communication.

The Paper Nautilus, though classed by
most authors as a Nautilus, is of a distinct
genus: it not being of a chambered struc-
ture.

The species of Nautili are few. Au-
thors make two sorts of the East Indian
or pearly kind, to wit, the umbilicated
and non-umbilicated; which I assent to.

This pearly Nautilus is by several au-
thors very erroneously called Nautilus Græ-
corum: whereas the Nautilus of the
Greeks was the Paper Nautilus, not this
kind.

The animal of this Shell is said to inha-
bit only the uppermost or open chamber,
which is greatly larger than the others.
The rest remain empty, except that the
pipe, or siphunculus, which communicates
from

from chamber to chamber, is filled with an appendage or tail of the animal*, like a gut or string†.

Mr. Hooke (Philosophical Experiments and Observations, p.306.) imagines the animal uses this tail or gut, which fills the pipe or siphunculus at will, as its necessities require, to exhaust the water or air from the chambers, or *vice versa*, to fill them with either; by which actions he

* See the Gentleman's Magazine many years ago on this subject. The siphunculus is a dilatable tube under the command of the animal. When it is dilated, like the swimming-bladder of a fish, it renders the Nautilus buoyant. When it is contracted, the fish and shell sink, and just to such a degree as the present occasions of the animal require. I believe no water ever enters this tube.

† I have my doubts whether the Nautilus fish inhabits more than one chamber of his Shell. I think it does not; for if it does, how is the fish ever got from those chambers, as the siphunculus is so small?

renders

renders himself of more or less specific gravity, to sink or swim.

These opinions however are merely speculative, for I cannot find we have acquired an accurate history of the animal, or its way of life. Rumphius indeed gives a figure and description of the fish; but I am of Breynius's opinion, that it is so confused and unintelligible, as not any information can be gathered from it.

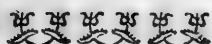
Plancus describes and figures some very minute recent Nautili from the sea sediment at Rimini. Gualtieri refigures three species of them, Tab. 19, A. B. C. They are so minute that three and thirty of them hardly equal a grain in weight. Linnæus has entered them among his Nautili.

I have seen two remarkable fossil kinds yet undiscovered, living or recent from the sea, viz.

A Nau-

A Nautilites about the size of a pippin, quite pyritical, without the slightest vestiges of the natural Shell. It is deeply umbilicated, has fine foliaceous futures in several parts, and besides is thickly and finely ridged across from side to side, the ridges not straight, but curved, the curvature tending downwards, or from the mouth. This is in the elegant collection of my esteemed friend Mr. Ingham Foster, of London.

A small kind, with undulated or zigzag futures, found in the limestone of Derbyshire and in Germany.



SECTION IX.

PART III, revolved Shells, or Shells whose spires are latent, or hidden within the body, and do not in any manner appear externally; so that they have no clavicle or turban*.

The common Nautilus is also a revolved Shell, but being more remarkable for its chambered structure, it is arranged in Part second.

This third part contains three families, to wit, family sixth, Nuces seu Bullæ, the Pewit's Eggs, or Dipping Snails. Seventh, Semiporcellanæ. Eighth, Cypreæ seu Porcellanæ, the Cowries. *(Vid. add. p. vi.)*

The sixth family is the Nuces, seu Bullæ, commonly called the Pewit's Eggs, or Dipping Snails, but which I shall hence-

* Univalvia turbinata, clavicula intus recondita, vel ita in se contorta, ut eorum circumvolutiones nulla ex parte promineant. Turbinata involuta.

forward

forward call Dippers, or Sea Nuts. The definition of this family I make as follows; most generally of an oval shape, and umbilicated at bottom. The mouth very patulous, especially at the top, for it narrows greatly downwards. The lip thin, sharp, and naked, or without any border or other work; and with a small facing or columella lip on the upper part of the mouth. Pl. III. fig. 4, 5, a Nux, or Dipper, shewn on both sides.

The arrangement of this family is much confused in authors, by their seeming connexion with the two following families of Semiporcellanæ and Cypreæ. Lister makes them a genus of Cowry, and calls it *Concha Veneris basi umbilicatâ*. Grew and Buonanni place it with the Snails. Rumphius, with his *Cochleæ Globosæ*; Argenville, Davila, and Meuschen do the same; and, indeed, Linnæus's genus of *Bulla* is of the same complexion; for it also includes the figs, turneps, &c. equally with the Dippers. Gualtieri makes it a genus

preceding

preceding the Cowries, and following the Paper Nautili.

The arrangement that Rumphius, Argenville, Linnæus, Davila, and Meuschen, give them as *Cochleæ Globosæ*, or Tuns, is very surprizing and extremely erroneous: since they have a very different essential character, though all have patulous or very large mouths. For the Nuces, or Bullæ, like the Cowries, have no clavicle or turban; because their spires are latent within their bodies: whereas the *Conchæ Globosæ*, as the Partridges, Tuns, &c. are really turbinated Shells, and have a very fair and strong external clavicle, but it is generally flattish, or not much produced.

Though there is a vast difference of colouring in the Dippers, I am, nevertheless, inclined to think they are only varieties, and that this family is not numerous.

The seventh family is the Semiporcellanæ, or Shells greatly resembling the Cyprææ or Cowries in their appearance. Their aperture, however, is not so narrow, but more open, neither are the lips toothed or dentated; which are the differential characters I establish between the two families.

I have already observed, that Grew, Rumphius, Seba, Argenville, Gualtieri, and others, have ranked them as Cowries. Lister calls them *Concha Veneris aperturâ non dentatâ*. Linnæus makes a genus of them he calls *Bulla*; in which he also includes my preceding family of *Nuces* or *Dippers*. Davila, refining on Argenville, divides the Cowries into two genera, of toothed and not toothed; which latter is this kind; and Meuschen, in like manner, makes them a division of Cowries by the name of *Semiporcellanæ*.

The

The species of this family are not numerous ; but among them the Weaver's Shuttle, Pl. III. fig. 3, the Poached Egg, and some others, are esteemed rare and curious Shells.

The eighth family : *Cyprea* vel *Porcellana*, the Cowry, Shells generally femioval, whose flat part is the mouth. The spires of the Cowries in no wise appear externally, but make their revolutions quite latent, or within the body of the Shell. The aperture is on the flat side ; it is a narrow opening, or fent, the length of the Shell. The lips near together, broad, turning inwards, and toothed ; the two ends or extremes on the upper part are very bumped and prominent. At one extreme it has a wry gutter, or opening, like the mouth of a foal or other flat fish ; the other extreme has also a gutter, but it is strait or perpendicular ; and aside of it, in some kinds, there is another protuberance like a small rude clavicle or turban.

N

The

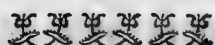
The particular character of this family I make to be the deep tothing on the inner edges of the lips, which distinguishes it from the foregoing family of Semiporcellanæ. Linnæus has kept to this character; but Grew, Lister, Argenville, Gualtieri, and others, not regarding it, have confounded them all together.

The Cowries are extremely numerous, and most of the species very beautiful in colour and polish. They have this elegant polish even from the sea, naturally, or without the aid of art; and were they not common Shells, would perhaps be as highly valued as the Volutes or any others.

It is of no importance to enumerate any of the kinds. I shall only remark, that they seem to be litoral Shells, and chiefly to inhabit the seas round islands; for the greatest number of them are found at the Moluccas, the Maldives, Madagascar, the West India islands, &c.

Though

Though the Cowries are found in immense abundance in the recent or living state, they are very rarely found fossil; and as they lose their colours when in the fossil state, it is impossible to determine whether any of them are Species yet undiscovered recent. However, the kinds found fossil near Turin, and in France, seem to be well known in the recent state. Pl. III. fig. 1, 2, a Cowry, or *Cyprea*, shewn on both sides.



SECTION X.

PART IV. turbinated or spiral Univalves.

The turbinated Shells, properly so called, are those Shells whose spires are external, and shew themselves on the outer part of the Shell in what is called the clavicle or turban (clavícula) which is either produced short or flat, according to the several genera or species.

It is this fourth part, or turbinated Univalves, which is the most difficult to arrange, and in which authors, in their different systems, have displayed their different opinions. No wonder ! since it not only contains myriads of species more than all the other three parts put together ; but besides, the characters of them are fraught

5

with

with innumerable difficulties not easy to surmount.

The several authors have formed their methods from one single, or from a combination of characters; but I reject all the systems hitherto broached: and, as I observed, there should always be one head character, deduced from the principal or chief part of the object, which character should run through the whole system, to preserve a perfect regularity; I have fixed on the aperture or mouth of the Shell, for this head character of my system or arrangement of turbinated Univalves. The aperture or mouth will therefore be the touchstone of my families; and the shapes, clavicles, colours, and works of the Shells, I shall use only as subordinate characters.

Having thus fixed the head or essential character, I shall begin with those Shells that are the most simple, or least turbinated, and very patulous, or almost wide

open ; therefore the first set, which constitutes the ninth family, is the Cymbium, or Paper Nautilus. Plate III. fig. 6.

This family, it is true, has no external spires, nor indeed is it, strictly speaking, a turbinated Shell, except at the very head, which turns in one spire only ; but, the Shell being quite open, this spire is exposed to view ; for it is evident, if the Shell was not open, or vascular, but, on the contrary, was closed or shut up, it would come under Part III. of Revolved Univalves : as the spires like in the common or pearly Nautilus would be hidden, or turn within the body of the Shell. However, though so unlike the Nautili in not being chambered, yet, in form and other particulars, it much agrees with them.

The definition of the Cymbium family I state thus. Shells, in their external shape resembling a ship or boat, whose
upper

upper part or head is narrow, turns spirally, and is like the stern ; the rest of it widens to the other end, is quite hollow, forms a horizontal aperture, and lies lower than the stern or spiral end.

The species of this family are very few, not above three or four. And those known are brownish or whitish, and thin almost as paper, whence they have obtained the name they bear of *Paper Nautili*.

These Shells have by most authors been ranked with the common Nautili, by the name of Nautili Vacui, on account of their failing ; but it is evident, that in structure they have not the least affinity to one another.

Gualtieri has made them a different genus, and named it Cymbium, which name I have adopted. Linnæus also makes it a distinct genus, and calls it Argonauta.

It is this family that is the true Sailor, the very Nautilus or Pompilus of the Greeks and Latins, and which our celebrated English poet refers to,

“ Learn of the little Nautilus to fail :”

for I do not find that it is proved in any satisfactory manner, that the other kind, or pearly Nautilus, ever fails, or navigates his Shell.

Pliny *, as usual, gives a concise but elegant recital of its navigation. It fails, says he, after having discharged or pumped the water from its Shell, aloft on the sea, extending a membrane of an admirable

* Plinii Hist. Nat. lib. ix. c. 29. Inter præcipua autem miracula, est qui vocatur Nautilus, ab aliis Pompilos. Supinus in summa æquorum pervenit, ita se paulatim subrigens, ut emissa omni per fistulam aqua, velut exoneratus sentina, facile naviget. Postea prima duo brachia retorquens, membranam inter illa miræ tenuitatis extendit. Qua velificante in aura, cæteris subremigans brachiis, media cauda, ut gubernaculo, se regit. Ita vadit alto, liburnicarum ludens imagine, & si quid pavoris interveniat, hausta se mergens aqua.

thinness,

thinness, and casting backwards two of his arms, for he rows with the others, he steers his course, till, refilling his Shell with water, he sinks himself to the bottom.

These Shells are found in many parts of the Mediterranean, and also in the East-Indies. Mr. Argenville, in his *Zoomorphose*, p. 29, gives us a recital of the latest observations relative to the animal and its sailing. The fish is of the Polypus or Pourcuttle kind ; its head is pretty big, with two large eyes ; it has eight arms or legs, of a soft fleshy substance ; they are thicker towards the body, and are connected, or webbed together, by a slight membrane. They are of a silvery colour, set with suckers or knobs on the sides, are flatted like oars, and serve him to swim ; and with these he seems to row and steer his vessel. The six foremost are short, and he balances himself and extends them as he swims. The two hinder ones, longer than the others, he plunges in the
sea,

sea, to serve as a rudder; and these uphold the skin, or membrane, which he uses for a sail to ply the wind. Thus equipped, he navigates in calm weather; when fearful of danger, he retires within the Shell, by which action it gains water, and sinks to the bottom. He often pumps the water out, and also often quits the Shell, which, floating empty, is carried by the waves, and dashed to pieces on the rocks.

The fish quits the shell at pleasure, for he is not attached to it by any part of its body. Frequently he turns himself and shell topsy-turvy, and rises with his head downwards from the bottom of the sea, and, when he has gained the surface of the water, turns his shell very nimbly empties the water in it, extends his arms, and sets sail. They are frequently found without their Shells; and the fishermen must even be extremely expert to catch them in it*.

The

* I much suspect this account; but I cannot deny it to be true, though I know not of any animals, that
have

The tenth family I shall call the Ear Snails, or *Auris-Cochlea*, a combination of two names, which expresses the affinity these Shells have to the Sea Ears, while, at the same time, they are truly a kind of *Cochlea* or Snails. This Shell is called the Venus Ear. See Pl. III. fig. 7, 8, in two views.

Their shape so much resembles the Sea Ears, that most authors have ranked them in that family, and call them non-perforated Sea Ears. Lister and Gualtieri rank

have proper domicilia, who quit them voluntarily. Fear or necessity may possibly cause this separation sometimes. Besides, as this animal may be supposed to frame its own habitation, like others of the testaceous kind, it seems necessary to have an attachment, however slight, to some one point, as that from which it uniformly extends itself for the formation of its shell: if this was not the case, is it possible to conceive, that a shell so delicate, so regular in every respect, could be fabricated?

them

them as Cochleæ, and Linnæus places them in a genus he calls Helix.

I define the Auris Cochleæ, or Ear Snails, as follows. Shells so wide and open as to resemble Sea Ears, but are not perforated or set with a row of holes. They have a broad ledge along one side, which projects over the cavity, and turbinates into one single flat spire, quite even or level with the bottom of the Shell. This spire is also very wide, and extends to near the middle of the bottom or under part: so that this family absolutely participates of the characters and shapes of the Sea Ears, and of the Snails, and is, as it were, a combination of those two families, as also one of the innumerable instances of the insensible progressions nature takes from one family to another; which progressions baffle human powers to limit, or the refined definitions of the most accurate naturalists.

There

There are very few Shells of this family.

The eleventh family is the Cylindri, Cylindars or Olives. Shells of a cylindrick form, and ending pointed at the lower end; the mouth is long, narrow, (*apertura linearis*), and notched on the top; the notch turning backwards, is large and somewhat awry, like the mouth of a flat fish; the pillar is faced half way down, and is greatly wrinkled or pleated; the turban generally short, very pointed, and with the whirls or spires nearly level, or meerly prominent one from the other; and the turban itself is divided from the body by only a meer prominent line. Pl. V. fig. 4 the Panama or Camp. Pl. V. fig. 7, another Cylindar or Olive.

This family in most authors is placed nearly in the same manner. Lister calls them

them, Rhombi five Strombi Cyindracei, Lib. iv, Sect. x. Part 1. c. 1 & 5. Rumphius forms a Genus of them he calls Cylindri. Argenville makes them his eleventh family, and names them Rhombus, Cyindrus, vel Olea. Davila places them as two Genera of Volutes, viz. as the second genus or cylindrical Volutes or Rouleaux, and as the third genus or dentated Volutes or Olives : and Meuschen, whose seventeenth genus they are, also calls them Cylindri five Dactili.

Gualtieri names them Cochleæ Cyliandroideæ, and places them the next Genus after the Volutes, to wit, Genus 2. of section I. of class 1. of the third part ; and Linnæus ranks them in his Genus of Voluta, by the name of Cyliandroideæ.

This family I shall divide into two genera, viz.

Genus

Genus 1. *Cylindri emarginati*, or such whose edge is quite even and sharp. And

Genus 2. *Cylindri marginati*, or such whose edge is not sharp and smooth, but has a very thick border, which turns over into a very prominent ledge on the back, like to the Helmets.

The species of this family are many, and very beautiful Shells.

The twelfth family of the Univalves is the *Voluta* or *Volute*. It is very numerous in its species, and is the family which, for richness and beauty of colouring, surpasses all the other families of the Univalves, and is reckoned the ornament or capital object of collections. The far greater number of *Volutes* always bear a value; some kinds, as the Admirals, &c. have fetched surprizing prices when perfect

fect Shells ; and the *Cedo Nulli* is so extremely rare and beautiful, that it is now rated at the prodigious sum of one hundred guineas. Pl. V. fig. 3, 8, and 9. are Volutes.

The Volutes are Shells of a pyramidical or conic shape, for the base is flat and wide, and the body rises gradually into a sharp point at the top. The turban is the base, and all the whirles are distinguished by slight linear prominences: some kinds have this base quite flat, or a perfect Helix, as Pl. V. fig. 9. In others it prolongs into a sharp clavicle, as in the Imperial Crown, the Fleabite, the Flamboyante, as in Pl. V. fig. 3 and 8. However, these differences of the turban or clavicle are not essential enough to cause a subdivision into different genera ; though Davila's second genus of Volutes, he calls Rouleaux, is formed on these differences.

The

The aperture of the Volutes runs the length of the Shell: it is so extremely narrow as to be linear, (*apertura linearis*) is all along of equal breadth, and resembles a meer slit or fent. The Volutes have no inner lip.

Dr. Lister calls the Volutes, Rhombi vel Strombi Cylindro-pyramidales, Part II. Section X. of lib. iv. Linnæus calls the genus *Conus*, and transposes the name of *Voluta* to the Mitres, Persian Crowns, Cylinders, and other Univalves, that have their pillar pleated or wrinkled. Gualtieri calls them *Cochleæ conoideæ*, the first genus of part iii. class i. or *Cochleæ longæ*; and most other authors, as Rumphius, Argenville, &c. make a distinct genus of them, by the established name of *Voluta*.

The thirteenth family I shall call *Globosæ*, or Tuns, and define them, Shells most generally of a somewhat globose
 O shape,

shape, the body being greatly swelled, or rounded, from whence they acquire the name they bear of *Globosæ*, or *Tuns*. They have short turbans; the mouth is extremely patulous or wide, and very large; the upper part of it ends in a wry channel, like a foal's mouth, which is very short, and turns backwards. None have a pillar or columella lip; though in some, as the Persian Crowns and Melons, the columella or pillar itself is wrinkled or pleated. Pl. IV. fig. 8. a small Melon. Pl. IV. fig. 9, a curious and rare knobbed Tun.

The Shells which come under this family are the Tuns, Partridges, Figs, Harps, Persian Crowns, and Melons.

The rank of this family, in systematical authors, is, that Lister places those with a wrinkled or pleated pillar, as the Persian Crowns, &c. among his Whelks of the same structure, Lib. iv. Section XI. the

Tuns

Tuns and Figs among his *Buccina Ampullacea*, Section XIII. and the Partridges, in cap. iv. of Section XV.

Linnæus likewise places those with a wrinkled or pleated pillar, on account of that structure, in the genus he calls *Voluta*; and the Partridges, Tuns, Harps, &c. among his *Buccina*.

Rumphius calls them *Cochleæ Globo-fæ*, as also Argenville, who makes them his fourteenth family; Davila his ninth family, and divides them into three genera; Gualtieri has placed the Figs as *Cochleæ Pyriformes*; and the Tuns he calls *Cochleæ Cassidiformes*, and *Cassida*.

This family is not very numerous; however, it contains some extremely beautiful and curious Shells.

The fourteenth family is the *Cassides* or *Helmets*. I define it Shells semi-globose, the back being very convex or round,

the under, or mouth part, flat. They have near flat, or, at most, very short clavicles or turbans. The mouth is long, rather narrow, and ends at top in a gutter, which turns very large, strong, and wry on the back ; the lip is always strongly and thickly toothed, and rises into a high thick border, or ledge, on the upper part or back ; and the pillar is most generally strongly toothed, ridged, or set with small bumps or asperities. Pl. IV. fig. 10, a helmet shewn on the flat or mouth side.

Some systematical authors have agreed with me in making a distinct or particular family of these Shells, and call them Cas-fides. Such are Rumphius, Meuschen, and Gualtieri.

Linnæus ranks them as Buccina, Argenville and Davila as Murices ; and, lastly, Lister among his Buccina, Lib. iv. Section XV. c. 7 and 8, by the name of
bellied

bellied or swelled Whelks with a wry mouth.

This genus is not very numerous, but some of the species are extremely large and heavy.

The fifteenth family is the Trochi, or Tops. Shells of a conic or pyramidal shape, the top being broad and flattish, and gradually tapering thence to a very sharp point. The aperture or mouth is most generally angular, low, and narrow. Pl. III. fig. 13. a trochus.

It is remarkable, that all the authors who have wrote on Shells, agree in this genus and in its characters ; so that few Trochi are found misplaced.

It is a very numerous family, and abounds with curious and fine Shells.

There is a fossil species of Trochus, which to me seems yet undiscovered re-

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cent. A large kind, flattish, and like a *Cochlea Helix*, generally about two inches in diameter, and strongly and thickly wrinkled, with sharp prominent ridges like plates, which are spiked at regular distances; these run across the spires; but the whole Shell is likewise slightly striated, according to the run of them. This *Trochus* is found in the Limestone of Coalbrookdale in Shropshire, and Dudley in Staffordshire.

The sixteenth family is the *Cochleæ*, or Snails; the character of which is a round mouth or approaching thereto, perfectly bordered, circumscribed, or defined, (ore integro.)

I shall divide this family into five genera; to wit,

1. *Nerits*, (*Nerita*) or Snails with semicircular mouths. (*Semilunares*.) Pl. III. fig. 14.

2. *Helices*,

2. Helices, or Snails that are flattish, and whose spires lie, as it were, between two planes or levels. Pl. III. fig. 10.

3. Snails with a short or flat turban. (*Clavicula brevior.*) Pl. III. fig. 11.

4. Turbo, or Snails with a produced or lengthened turban. (*Clavicula longior.*) Pl. III. fig. 12.

5. Cochleæ Strombiformes, or Snails whose turbans are extremely long and slender. (*Clavicula tenui & longissima.*) Pl. III. fig. 9.

I shall take each of these genera separately. And to begin : The first genus, or Nerits, are Shells whose mouths are a half circle, the columella or inner lip running diametrically across it in a straight line. This lip is very broad or faced, and extends greatly on the columella. They

are very full-bodied Shells, nearly globose ; and the turban is never much produced, but lies flat or level with the bottom.

The Nerits are most generally toothed on both lips.

The arrangement of this genus in all authors is near to or with the Snails ; and they are most generally called Nerits. Rumphius calls them *Cochleæ Valvatæ*, and by many they are also called *Semilunares*.

The species of this genus are very numerous, and they are generally beautiful Shells. Pl. III. fig. 14, the Magpye Nerit shewn in two views.

There is found, in a calcareous substance in France, a large kind of fossil Nerit, which I shall call the *Limpet-like Nerits*. It is a very thick Shell, size of an apricot, and rather flattish. The
upper

upper side is fine chestnut brown, somewhat convex, and rises to a knob or point which is not central, but placed sideways. It is this upper side that resembles a Limpet. The under part is quite milk white, flattish, and round; the mouth semicircular, the inner lip rises or swells, expands or faces quite to the upper side, and is toothed with two strong teeth. It is a very curious species, and is still undiscovered recent, or from the sea.

Helix. My character of this second genus is, that they are most generally round mouthed Snails, whose spires lie horizontal, or between two levels. Pl. III. fig 10, the Planorbis River Snail.

The arrangement this genus bears with systematists is among the Snails. Most of them being land or fresh water Shells, are placed by Lister among the terrestrial and fluviatil Snails; and the Dolphin, a sea kind, he has placed, Lib. iv. among the
sea

sea snails. Gualtieri, like Lister, places many among the land and river Shells; and the sea ones he ranks as *Cochleæ depressæ*. Argenville and Davila place them with the *Cochleæ ore depresso*, or *Trochi*; and the other authors rank them indiscriminately with Snails, by the names of Post-horns and Lamps.

There are many curious species of this genus.

The third genus of Snails has a very short, or but little produced turban, (*Clavicula brevior*) and that is their only character, they agreeing in the mouth and other particulars with the rest. Indeed, I have formed this genus more for regularity and clearness in the method, than on account of its having any essential distinct character; and in most authors they are indiscriminately intermixed with all the Snail kind. Pl. III. fig. 11, the umbilicated whitish thin Snail.

However,

However, as it renders the method more easy, I have ranked them in a distinct genus: for it is very fertile in species, the common land Snails and many others numbering in it.

The Snails with a produced or lengthened clavicle or turban, (*Clavicula longiore*) which I shall particularly call *Turbo*, form the fourth genus. These most generally have a perfect round mouth; the columella or inner lip is not much faced outwards, and the body spire is very belied, so that the turban is not insensibly, but suddenly or disproportionately produced from it, like as in the *Buccina*. Pl. III. fig. 12.

The arrangement and names this genus of *turbo* bears with systematists is as follows. Lister places them as a section of the Snails. Gualtieri calls them *Cochleæ Marinæ Terrestriformes*. Rumphius, Argenville,

genville, Davila, and Meuschen, Cochleæ Lunares, or round mouthed Snails, and Linnæus, Turbo.

There is a vast number of species of this genus, most part very fine Shells. Among them is the Gold Mouth, the Silver Mouth, the Serpents Skin, the Midas Ear, Land Snail, &c. And if that valuable Shell the Wentletrap proves not to be a *Vermiculus Penecillus*, as I have hinted above, then it is a Shell of this genus.

It is an anecdote of the Wentletrap worthy to be transmitted, as it shews the value of particular species at times, that in 1753, at the sale of Commodore Lisle's Shells at Langford's, four Wentletraps were sold for seventy-five pounds twelve shillings, viz.

	£.	s.
First Day, Feb. 21, Lot 96, one } not quite perfect - - - - }	16	16
Third Day; Lot 98, a very fine } and perfect one, - - - - }	18	18
Fourth Day, Lot 101, one for -	16	16
Sixth Day, Lot 83, one for - -	23	2
	<hr/>	<hr/>
	£. 75	12
	<hr/>	<hr/>

The fifth and last genus of Snails is what I shall call *Cochleæ Strombiformes*: (*Clavicula tenui et longissima*) for they are very long and slender Shells, tapering to a sharp point, and therefore exactly resemble the Needles or Strombi, whence I have named them *Strombiformes*. Pl. III. fig. 9.

These Snails have a perfect round mouth, well defined or bordered, by which particular alone they are immediately distinguished from the Strombi, whose length and slenderness they emulate; for the mouths

mouths of the Strombi are long, and have a very thick columella aside them, erect, and somewhat twirled; and many kinds besides prolong into a wry gutter, turning backwards, like the mouth of a Soal, or other flat-fish.

The first, or body whirl or spire, is not more than proportionably swelled, so that the whole Shell gradually tapers to a sharp point.

Lister, who is critically methodical, has arranged this genus as Snails with a very long and slender turban. Rumphius intermixes them with the Strombi, as does also Argenville, Gualtieri, and Davila, who call them Turbo or Strombus. Meuschen likewise intermixes them, and Linnaeus ranks them in his genus of Turbo.

There are not many species of this genus.

A fossil

A Fossil kind is found in the sand pits at Woolwich in Kent, in immense quantities, which to me seems to be a species yet undiscovered living or recent from sea. I call it *Cochlea Strombiformis, clavata*, from one inch and a half to two inches long, wrinkled, or striated the run of the spires, and each spire is also circularly set with a row of depressions, like the marks of heads of nails.

The seventeenth family is the *Buccina*, in English *Whelks*. It is chiefly this family that creates the many differences among authors, and the confusion that is hardly to be unravelled. The immense quantities of species it contains, and the many subordinate characters of them; which subordinate characters most authors have attended to, and made them essential instead of subordinate, has produced all the perplexity and confusion we meet with relative to this family.

The

The error of authors in setting aside the figure of the mouth, which I make the essential or head character of all turbinated Univalves ; and framing their genera from subordinate characters, is not more visible in any family of the testaceous animals, than in this. For the Shells called *Buccina* by the several Conchologists, instead of being a set of similar mouthed Shells, is indeed a farrago, or jumble of several families, all placed pell-mell, or confusedly together : and Lister, though erroneous in several particulars, by ranging many kinds not truly *Buccina*, with *Davila*, are, in my opinion, the only authors who have arranged this family with any propriety or order.

Argenville, after criticising Lister very unjustly, as I have already observed, makes the essential or head character of *Buccina*, to be a broad and very lengthened mouth : but he nowise further distinguishes the
several

several genera, and therefore is a scene of confusion. Davila, who follows and corrects his method, defines them to have a large oblong aperture, and divides them into four genera; but the first genus which he calls whole-mouthed *, without a tail or gutter, is my genus of Turbo among the Cochleæ or Snails, and are not Buccina; for their mouth is perfectly circumscribed or bordered: such are the Midas's Ear, and others; for these Shells, though in shape and appearance they seem Buccina, yet, their mouth being perfectly circumscribed or bordered, and devoid of gutter or break, strongly distinguishes them. Linnaeus defines the Buccina extremely well by an oval aperture ending in a gutter; but his sections of them are perplexed and vague. The other authors, as Buonanni, Rumphius, Seba, &c. give no character for Buccina, but range Shells as such, only as their fancy surmises.

* Buccins, à bouche entiere dépourvue de queue.

I shall now define all Buccina to be Shells whose mouths are an oblong or very lengthened oval, the upper part whereof is produced or lengthened into a gutter or slight beak: all other characters are subordinate, and serve only to constitute the different genera of the family.

On this principle I shall divide the family of Buccina or Whelks, into the six following genera, viz.

1. Buccina Canaliculata, vel Buccina rostro Canaliculato. Guttered Whelks, or those whose upper part of the mouth ends in near a strait, and somewhat prolonged gutter. Pl. I. fig. 3, 4, 5.

2. Buccina Recurvirostra, vel Buccina ore quasi abscisso, Canaliculo recurvo; Buccina plagiostoma. Wry-mouthed Whelks, or those whose mouth is, as it were, cut short at top, for the gutter or beak does
not

not extend streight forward from the upper part of the mouth, but bends or falls on the back, in a wry manner, exactly like the mouth of a sole or other flat fish. Pl. IV. fig. 1, 2.

3. *Buccina Rostrata*, vel cum rostro longissimo. Beaked Whelks, or those which have a very lengthened beak ; as the Crane, Spindle, *Purpuræ*, &c. Pl. IV. fig. 4, 5. Pl. V. fig. 6.

4. *Buccina Umbilicata*. Umbilicated Whelks, or such as have an umbilicus or perpendicular hollow, or navel, aside the columella or pillar-lip, on the first or body whirl. Pl. IV. fig. 6.

5. *Buccina Columella dentata*, vel plicata. Whelks with a wrinkled, or pleated pillar. In these the Columella or Pillar-lip is wrinkled, ridged, or wrought with pleats. Pl. IV. fig. 3.

6. Strombi, or Needles, are *Buccina* with a very long and taper clavicle or turban, and a wry-mouth turning on the back, in some species of such length as to be like a spur. Pl. IV. fig. 7.

Genus 1. *Buccina Canaliculata*, or guttered Whelks ; because the top of the mouth prolongs itself somewhat into a near strait cylindric gutter, and the inner or columella-lip is always extremely smooth. Pl. I. fig. 3, 4, 5, a common Whelk.

The species of this genus are very numerous. The varieties of work and shape, which are only subordinate characters, are amazing.

The rank these guttered *Buccina*, or Whelks, hold in systematical authors, is as follows : Lister's section xiv. of his Book IV. is, for the greater part, of this genus. Gualtieri places those with short clavicles or turbans, Tab. 26, among what

he calls *Cochleæ pyriformes*; and those with produced turbans, tab. 43, he calls *Buccina*. Davila makes them the third genus of *Buccina*, which he calls *Buccina* * whose mouths terminate in a short tail. Linnæus strangely intermixes them among his several sections; and the other authors place them indifferently, and only as *Buccina*.

Genus 2. *Buccina recurvirostra* five plagiostoma, *Buccina* oris apice quasi abscisso, rostro vel Canaliculo parvulo recurvo, & extrorsum porrecto. Wry-mouthed Whelks. The top of the mouth of this genus is not prolonged or extended forward, but has a notch or crooked gutter, which turns outwards on the back, and exactly resembles the mouth of a sole or other flat fish. Pl. IV. fig. 1, the furbelow, and fig. 2, the Grimace,

* Buccins, à bouche garnie d'une queue peu longue,

The species of this genus are very numerous; and the varieties of their shapes and works are vastly diversified.

I do not find that any authors, except Lister and Davila, have made a separate genus of these *Whelks*, solely on account of this character. Lister ranges most of them in sect. xv. of lib. iv. and calls them *Whelks** whose tops are short, or do not extend beyond the mouth. Davila makes them his second genus, which he calls *Whelks*† with a notched mouth without any beak.

The third genus of *Buccina* I make to be those with a very long and extended beak, (*Buccina longirostra*), such as the *Purpuræ*‡, *Tower of Babel*, *Crane*, and

* *Buccina* qua rostrum breve oris hiatum non excedens.

† *Buccins* à bouche échancrée, depourvue de queue.

‡ The *Purpuræ* are properly to be placed with these *Buccina longirostra*, and not form a distinct genus, for the distinctions between them are not built on real or decisive characters.

others

others. Pl. IV. fig. 4, the Crane, and fig. 5, the Thorny Woodcock.

I do not meet with any author except Davila who agrees with this genus, and he makes them his fourth genus, which he calls Buccina *, whose mouths are furnished with a very long tail or beak.

The Purpuræ prey on other Shell fish, and for that purpose bore a round hole in the shells of the fish they feed upon, by passing their tongue, which is hard, boney, long, and sharp, through the hole it bores. This practice of the animal was observed by the antient naturalists; Aristotle de *Part. Animal.* l. ii. c. 17. *versus finem*; and *Plinii Hist. Nat.* l. ix. c. 36. The latter says, the tongue of the Purpura is a finger's length, by which it preys in boring or perforating other Shells, it is of such hardness. However, I cannot conceive

* Buccins à bouche garnie d'une longue queue.

that the animal, properly speaking, can bore or perforate Shells, as it would imply a motion of turning briskly backwards and forwards, or on an axis or point, motions it cannot well be capable of. Perhaps therefore it may perform this action of perforating other Shells by virtue of some menstruum it emits through the tongue, whereby it softens or corrodes the other shell, and then digs out the corroded substance with the beak, and all this without any versatile or other strong motion*.

Lister

* I suspect the doctrine contained in this article. To make this hole it is not necessary that the fish should have a rotatory motion; that is, that, like a wheel, the tongue should always move circularly the same way. It is sufficient that it turns briskly backwards and forwards. And, if the holes, which are most commonly found in some species of the *Chamae*, and the Screw Shells particularly, are examined with a glass, they will be found to be so finely circular, that it is impossible to conceive any menstruum should act upon it in so regular a manner.

Further,

Lifter has several Shells he calls *Purpuræ*, but these more especially are his *Buccina Ampullacea*. Rumphius and Linnæus place them among the *Murices*. Gualtieri calls them *uPrpuræ*. Argenville makes his thirteenth family *Purpuræ*, but gives no definition for them: and Davila follows him, except that it is his eighth family, and that he forms two genera of them, which I cannot say are well characterized.

The *Purpuræ* have obtained that name from the purple juice or dye the fish yielded,

Further, I do not apprehend the *Purpura* extracts its food by this hole. It is done with a view, either to force the animal out of its Shell, or to kill it, that it may devour it at leisure. There seems to be a wise choice in that part fixed upon. It is in such a part of the Screw Shell that the animal cannot crowd itself below the perforation, and escape the piercer: so likewise in the *Chamæ* and other Shells there is not the least reason to apprehend a menstruum.

which

which is so famous in history by the name of the Tyrian purple; because it is imagined, that a Shell of this kind was first discovered to afford it: but indeed most turbinated Shells yield a like purple liquor.

This family of *Buccina longirostra* contains many species very rare and curious.

Genus 4. *Buccina umbilicata*. Umbilicated Whelks, or those that have a perpendicular hollow or navel aside the columella or pillar-lip, on the first or body whirl. Pl. IV. fig. 6, the Joppa Whelk.

This is the positive character of the genus; and all *Buccina* or Whelks that have a hollow or navel rank under it, whether guttered, wry-mouthed, or beaked, &c.

There are very few species of this genus.

I do not find any author who has formed a genus from this second character, so that

that the Shells herein ranked are dispersed among their other Buccina.

Genus 5. *Buccina columella dentata vel plicata*. Whelks with a wrinkled or pleated pillar. The Shells of this genus have the inner or pillar-lip wrought with one or more high or prominent transverse ridges or pleats. Pl. IV. fig. 3, the Tiara or Papal Crown.

These transverse prominent ridges or pleats on the inner or pillar-lip, are the standard character of this genus; for all Whelks, whether beaked, guttered, &c. if the pillar is thus pleated, range herein; and there are of all kinds with this character.

However, it is very proper to observe, that it is only the Whelks whose pillars are pleated, that are to be arranged in this genus; for there are other families of Shells, as the Persian Conques, the Murices or Rocks, &c. which have their inner or pillar-lip wrinkled or pleated in the
same

same manner. Those are to be placed in their respective families, and not here solely on that account.

Lister and Linnæus are the only authors who have ranged any Shells by this subordinate character. It is Lister's section xi. of lib. IV. *Buccina columella dentata*; but he has not only arranged the *Buccina* therein, but likewise all other Shells whose pillars are pleated.

Linnæus has done the same; and from this single character of *columella plicata*, he has formed the genus he calls *Voluta*; in which not only *Buccina* are included, but also Olives, some Murices or Rocks, the Persian Crowns, Midas's Ear, and other Shells of different families, pell-mell, or confusedly intermixed.

The sixth and last genus includes the Strombi, or *Buccina* with an exceeding long and very taper clavicle or turban.

They

They have a wry-mouth exactly the same as the second genus, which sometimes extends or turns so far on the back, as to be like a spur. Pl. IV. fig. 7, a Strombus.

All Shells so prodigiously tapering and long have been generally held as a particular family, by the name of Strombi, or Needles, only on account of their taper shape, and without regard to the contour of their mouth. However, I have followed Lister, and only placed those Shells here which have a wry-mouth like the second genus; for all those that have a perfect round mouth, I have already ranked among the Snails, by the name of *Cochleæ Strombiformes*.

Lister, whom, as abovesaid, I follow, calls them Whelks with an extreme lengthened and tapering turban: however, he has erroneously placed them among the Whelks with a pleated pillar, Lib. IV. Sect. xi. cap. 3.

Gualtieri

Gualtieri has arranged all the taper Shells together, both round-mouthed and these, in his Part III. Class 5. and calls them Turbo, or Cochleæ with a small mouth, and remarkable lengthened or taper body. The French authors Argenville and Davila call them all, Turbo and Strombus (*La Vis* or *Screws*); and Rumphius likewise calls them Strombus.

Lister, on what account I cannot divine, has called the Olives, Rhombi or Strombi; but the great Linnæus has been pleased to change the established name of Strombus, always used for these taper Shells, to others of a quite different form; for his Strombi, except some few, are winged Shells or Alataæ. I have in another place taken notice of that celebrated author's licentiousness in changing and transposing long-established names, which I hold is very blameable.

The

The genus of Strombi is pretty numerous.

I have now finished with the Buccina or Whelks, known recent or living from sea. I therefore proceed to mention some fossil kinds, hitherto undiscovered in their living state.

First, the *Buccinum heterostrophum*, or other handed Whelk; because the whorls and mouth lie to the right hand instead of the left; which is the most general manner of turbinated Shells. This species belongs to the first genus, and is found in great plenty, in the fossil state, in the counties of Essex and Suffolk. However, it is said, a recent shell of this species was lately purchased for a noble collection.

Another fossil *Buccinum* from France, and Hampshire, a species of the fifth genus, or with a wrinkled or pleated pillar, yet unknown recent. Brander's Foss. Hantton. fig. 45. The

The Murices constitute my Sixteenth family. As they consist of many Shells that have very different subordinate characters, I shall form different genera of them ; but the fixed or essential character of the family, is an oblong and equally narrow mouth length ways, (*Apertura sub-linearis*) which runs into a short gutter at top. Most authors have added another character, that is, of always being thorny or spiked, bumped, or otherwise rough all over the surface, like the spikes or asperities of rugged rocks, from which it has obtained the Latin name of *Murex*, the English one of *rocks*, and the French name of *Rochers* : however, I cannot allow this character to be a fixed or essential one.

I shall subdivide the family of Murices or Rocks into four genera, viz.

Genus

Genus 1. Murex, Rocks, or those Shells that have a long and equally narrow mouth, (apertura sublinearis) and are externally very rugged. Pl. V. fig. 5, a Devil.

Genus 2. Rhombi, whose subordinate character is, that their shape or contour is rhombic. Pl. V. fig. 2.

Genus 3. Alatae, or winged Shells, whose lips extend into a large flap or wing. Pl. V. fig. 1.

Genus 4. Aporrhaidæ, or winged Shells, whose flaps or wings are bordered with large spikes or processes, like fingers, as the spiders, &c. Pl. I. fig. 6, 7.

It is needless to mention here the rank my several genera of Murices bear to other systems, for they are placed by most authors in a family called Murex, or among

Q

Buccina

Buccina, some particulars excepted, which I shall specify.

I now proceed regularly on each genus, viz.

Genus 1. Murex or Rocks. Shells whose mouth is oblong, narrow, and ends gutter wise at top; the clavicle or turban generally short or near flat, and the pillar is wrinkled or pleated. They are most commonly very thick Shells, and extremely rugged and rough on the outside, from their being wrought with bumps, prongs, foliated, and other works. Pl. V. fig. 1.

This genus is pretty numerous, and some of the species are vastly large and heavy.

Genus 2. Rhombi. Shells whose subordinate character is to have always a rhombic shape or contour, from which particular alone, as it carries an idea of

the subjects proposed, I have allotted them the name of Rhombi. Pl. V. fig. 2.

In the elder authors we find a set of Shells called Rhombi, seemingly a meer fantastic name without meaning or application. Thus Columna makes Rhombus, Turbo, Strombus, and Trochus, all synonymous terms. Lister, as I have observed before, calls the Volutes and Olives, Rhombi, or Strombi; and Sibbald, Woodward, &c. do the same; but in the later or modern authors, we seldom see the name of Rhombus used. This confusion apparently arises from the double meaning of the Latin word *Rhombus*, which not only signifies a lozange or rhombic figure, but also a reel, a spinning-wheel, a whirl, or other rolling instrument; and it is from this last similitude the Olives and such-like Shells have been called Rhombi by the elder authors, and not from a lozange or rhombic figure, as some have erroneously imagined.

However, I declare my appellation for these Shells is from their rhombic or lozange shape : for if one of this genus be laid down, or held, and its contour traced, the result will be the figure of a Rhomb or Lozange. This figure proceeds from the clavicle or turban, which is generally situated about the middle of the Shell, running out into very sharp or acute angles with the top and bottom, and thereby the whole Shell fairly exhibits a rhombic shape, or contour.

There is some reason to surmise, that many of these Shells are only growths of the next genus, or winged Shells. However, as it is not the case of all of them, and that they all now wear this described appearance, I imagine it is necessary to form this genus.

This genus is not numerous, but contains pretty Shells ; and some kinds are very large and heavy.

There

There is a very elegant fossil species of Rhombus, yet undiscovered recent from sea, found in France and in Hordell cliffs in Hampshire. It is curiously figured in Brander's *Fossilia Hantonienfis*. p. 31. Pl. V. fig. 64 à 68.

The third genus is the Alatae or winged Rocks ; for so I name them in common with most authors, from their lip being greatly extended, or expanded outwards, like a flap or wing. Pl. V. fig. 1.

Some few kinds have the flap or wing quite simple, or with the edges even ; but the greater part of these, as also of the next genus or Aporrhais, have always towards, or a little aside of the very top of the mouth, a broad hollowed sinus, which I call the *Scoop*, from which particular Lister calls them *Purpuræ seu Buccina Bilinguia*, and classes them Section XII. of Lib. iv. Rumphius and Meuschen make

a distinct genus of them, they call *Alatæ*. Davila ranks these by themselves in the third genus of his *Murices*, by the name of simple or not-pronged winged Shells; and Linnæus ranks all the winged Shells together in his genus of *Strombus*.

This genus is numerous, and contains many fine or beautiful species.

An elegant and large fossil kind of this genus, not yet discovered living or from sea, is found in Hordell cliffs in Hampshire; which is accurately figured in Brander's *Fossilia Hantonienfis*, p. 34. Pl. VI. fig. 76.

The fourth and last genus of *Murices* or Rocks, is the *Aporrhais*, or winged Shells whose edges are set with strong or valid prongs or fingers: as the Spiders, Devil's Claws, &c. Pl. I. fig. 6, 7.

Davila makes these his fourth genus of *Murices*, which he calls winged *Murices* with

with prongs or fingers ; but all the other authors have intermixed them with the foregoing genus.

The species are few, but they are fine Shells.

I have now gone through the first general division of Shells, or Univalves. This division is the most numerous of the testaceous animals ; for I do not hesitate to pronounce, that the species of Univalves surpass, by great numbers, the two other general divisions of Bivalves and Multivalves joined together. In this division of Univalves the wonderful works of the creation are also manifested by the immensity of beauties in their colours and structures. On this account it is that Univalves are the choicest objects of collectors, and bear more value than Bivalves or Multivalves ; for few of the latter ever fetch above five or six guineas, while numbers of the Volutes and other Univalves bear to ten, twenty, or thirty guineas, and even greater prices.



SECTION XI.

I AM now come to the second division of Shells or Bivalves ; that is, double Shells, or composed of two pieces or parts, which, by means of proper connexion by hinges, play on each other, so as to open, shut, and perform all other functions necessary to the œconomy or ways of life of the animals included in them, or whose habitations they are.

In relation to the fish or animals, I have already given some little account ; nor shall I further trouble my readers on the subject, as my system or method is built only on the habitations or Shells, and not on the animals, or any of their parts.

This division of Bivalves may be arranged into three general parts, to wit,

Part

Part 1. Shells that have unequal valves and shut close ; as the Escallops, Oyfters, Anomiæ, &c.

Part 2. Shells that have equal valves and shut close ; as the Cockles, Tellens, Mufcles, &c. and

Part 3. Shells with valves that never shut close, but are always open or gaping in some part ; as the Tridacnæ, Baſon Conques, or Bears Paws, the Chamæ, Pin-næ, and Solenes, &c.

Under theſe three arrangements all the Bivalves yet known may be ranked.

Theſe three arrangements are general ones ; but, as I have already obſerved, the chief or eſſential character of Bivalves is their cardo, or hinge : it is that character I hold as the principal one of the ſyſtem, and therefore by that character alone I ſhall rank the families.

But,

But, before I proceed on my system, I think it necessary to give a compendious view of the arrangements of Bivalves hitherto set forth by the several systematical authors, in like manner as I did before with respect to the Univalves.

Lister begins his history of the sea Shells with the Bivalves, which he divides into two parts, and into twelve families, viz. Part I. is of those with unequal valves, and contains three families, as 1. the Escallops. 2. the Oysters, and, 3. the Spondyles. His second part is of the Bivalves with equal valves ; this contains the other nine families, and are 4. the Margaritiferæ. 5. Many-toothed Cockles. 6. Toothed Cockles in many sections and chapters. 7. Muscles. 8. Pinnæ. 9. Tellens. 10. Solenes. 11. Chamæ ; and 12. Chama Pholas.

Lister, in his arrangement, has great regard to the character of the hinge, though he does not entirely build upon it.

His

His above method wants correction in his third family, or *Margaritiferæ*: in his seventh family, his placing the Noah's Arks or boats, as *Muscles*: in his ninth family of *Tellens*, which is not truly defined; and, lastly, in his making two families of the *Chama* and *Chama Pholas*, which in reality have no positive character to distinguish them.

Dr. Grew, in his *Museum Regalis Societatis*, p. 153, gives, as his seventh scheme of Shells that of the *Bivalves* and *Multivalves*; but it is so confused and puzzling as to be useless: however, his two chief divisions of *Bivalves* are into *inarticulate* and *articulate* hinges.

Breynius's scheme of *Bivalves* is very jejune and useless.

Argenville is the next systematist: he divides all his *Bivalves* into six families, viz. 1. The *Oysters*. 2. *Chamæ*. 3. *Muscles*,
Tellens,

Tellens, and Pinnæ. 4. Cordiformes, or Cockles. 5. the Escallops ; and the sixth and last family are the Solens.

This author's method is entirely arbitrary and very faulty ; nor does he characterise a single family by the cardo or hinge.

Gualtieri forms his method from those whose valves and sides are equal or similar ; which is his first class. His second class consists of those whose valves are equal, and their sides unequal or dissimilar : and his third class is of Shells with unequal valves. By this arrangement he rejects the hinges as characters, and mixes all the families together, solely on account of their similar or dissimilar sides, &c. so that it is impossible to collate his method with mine, in such manner as to be of any utility to the reader.

The method of Mr. Tournefort, which this author gives, divides all bivalves into two parts. First, Such as shut close all round ; and, second, such as are always open or gaping in some part. This division, though good, is incomplete, and his families and genera are very arbitrary.

Linnæus offers next. This celebrated naturalist divides all Bivalves into fourteen families, which he characterises by their hinges in a very accurate manner ; and his method seems to be the most perfect yet published. As I shall have occasion to recite this author's genera in collation with my own, I will enlarge no farther at present on his arrangements.

Mr. Davila forms six families of Bivalves, viz. 1. Oysters. 2. Escallops. 3. Chamæ. 4. Heart Cockles. 5. Tellens, and 6. Muscles ; but all is very arbitrary and confused.

Mr.

Mr. Meuschen makes eleven families, to wit, 1. Muscles. 2. Escallops. 3. Oyfters. 4. Arks. 5. Spondyles. 6. Cakes. 7. Bafons. 8. Hearts. 9. Chamæ. 10. Tellens; and 11. Solens. Most of these are misplaced, and some are unnecessary; but it is impossible to make further remarks on him, as his method is a meer sheet table without any explanations.

I do not make any mention of Buonanni, Rumphius, Seba, and several others, as they give no methodical arrangements of Bivalves.

However, there yet remains an author who merits particular notice, though not a professed Conchologist. It is Dr. Woodward I mean. The Doctor, in his catalogues of fossils, has given a very good method of Bivalves on the character of the hinges, and also on the form: but his system of Univalves is very faulty and imperfect.

imperfect. Dr. Woodward arranges all Bivalves in the following manner. Part I. Eared Shells, as 1. the Escallops. 2. the Spondyles ; and, 3. the Margaritiferæ. Part II. Shells not eared, and with unequal valves, as 4. the Oysters ; and, 5. the Anomiæ. Part III. Not eared, with equal valves, as 6. the Cockles. 7. the Cunei and Tellens ; and, 8. the Muscles : and those Shells which are always open or gaping in some part, he ranks, 9. the Solens ; 10. the Chamæ ; and 11. the Pinnæ.

I have now set forth the systems of the authors known to me, to shew how far they are perfect or erroneous ; but I shall remark, that all of them, except Woodward and Linnæus, seem no wise scientific, but arbitrary and confused.

Before I begin to detail my system, I think it very necessary to settle the technical terms or names for the parts of Bivalves, useful for making their descriptions intelligible

intelligible and easy, as also decent; for I hold in great detestation the obscene terms made use of by the Linnean School. Syst. Nat. p. 1069, 1070, &c.

The terms or names are as follow :

1. *The summit (Apex)* is the part whereon the teeth, joints, or properly the hinges are placed. Pl. VII. fig. 1. *a a*.

2. *The beaks (Umbones)* are the peaked ends of the Shell, which most generally stand behind the *summit*, or that part which answers to it. Pl. VII. fig. 1, 2, 3. *b b b b*.

3. *The margins or borders (marginæ)* are the edges or contour of the Shell, produced from the beak or hinge on either side. Pl. VII. fig. 1. *c c c c*.

4. *The surfaces, (superficies)* *concavitas* & *convexitas Concharum*; the convex expresses the exterior or convex side of the Shells, and the concave, the inside.

5. *The length* of a Bivalve is from the beak or hinge to the very opposite extreme. Pl. VII. fig. 1, 8. *dd*.

6. *The breadth* is from side to side. Pl. VII. fig. 1, 8. *ee*.

7. The margins or borders are said to be *similar**, if equally produced or extended from the summit, or of equal length; Pl. VI. fig. 1, 3, 10, 11; and *dissimilar*, if unequal or more extended on one side than on the other. Pl. VI. fig. 2, 4, 5, 6, and 8. Pl. VII. fig. 1, 5, 10, 11, and 12.

8. *The Hinge* (Cardo), strictly speaking, is the very part that connects the

* Conchæ æquilateræ sunt Conchæ ex utroque cardinis latere æqualiter effusæ.

Conchæ inæquilateræ sunt Conchæ ex utroque cardinis latere inæqualiter effusæ.

two valves together, that is to say, the teeth or joints on which they play in the actions of opening and shutting. Pl. I. fig. 13, 14, and 15. Pl. VI. fig. 1, 2, 3, 4, *a.* 11, *b.* Pl. VII. fig. 5, 11, and 15.

9. A hinge is *inarticulate* when not set with any visible joints or teeth. Pl. I. fig. Pl. VI. fig. 2, 3. Pl. VII. fig. 9, and 15. *Articulate* when set with some few. Pl. I. fig. 14. Pl. VI. fig. 4. *a.* 11. *b.* Pl. VII. fig. 1, and 5. *Multarticulate*, when set with many or a large number. Pl. I. fig. 15. Pl. VI. fig. 6 and 9. Pl. VII. fig. 11.

10. *The furrow, (Sulcus canaliculus)* is the gutter or furrow, when the Shells are closed that runs along parallel to the hinge.

11. *The slopes, (Declivitas)* are the places which slope or slant from the beak down the sides, and generally are slightly flatted, shallow, or concave. Pl. VII. fig. 2, 3. *fff.*

The

The *fent* (*Rima*) is the opening of the Shells on the fopes.

The cartilage (*Cartilago*) joins the valves together at the furrow and at the fopes.

12. The flat (*planities, latus complanatum*) is that fide of thofe Shells that is flat ; as the flats of the Heart Cockles, Bears Paws, &c. Pl. VI. fig. 5, 8, and 12. Pl. VII. fig. 4 and 10.

I fhall here repeat the obfervation made at the end of the Univalves, which is, that the fpecies of Bivalves are very few when compared to the immense numbers of fpecies of Univalves ; nor are they comparable to them for beauty : and, further, that there are no land Bivalves, and few of frefh water ; whereas the fpecies of Land Univalves are extremely numerous, and many kinds alfo occur in frefh waters.

Now to my method or fyftem.



SECTION XII.

DIVISION II. BIVALVES.

PART I. Shells that have unequal valves, and shut close.

Family 1. Pectens or Escallops. Though some species of this family have equal valves, yet, as the far greater number have unequal valves, to wit, a flat and a concave, I range them under this part. The same particular likewise occurs in the families of the Spondyles and Oyfters.

The head or essential character of the Escallop family, is a trigonal sinus. Pl. VI. fig. 1. *a.* and an elastic cartilage for its hinge in the very center of the top of the Shell.

The

The subordinate characters of Escallops are being eared ; indeed most authors have injudiciously made it the chief character, whereas there are other eared Shells besides Escallops, as the Spondyles, Margaritiferæ, &c. and, *vice versa*, there may be Escallops without ears. The other subordinate character is to have the top run into a perfect strait line, and thence gradually widen to a round bottom.

The species are numerous, some whereof are very curious and of great beauty, as the *Ducal Mantle*. Pl. VI. fig. 1. the *Compass* or *Sole*, the *Duck's Foot* or *Coral*, *Escallop*, &c.

It is worthy remark, that the colours of the under Shells of Escallops are always fainter than the colours of the upper Shells, and sometimes the valves are differently coloured, as the *Compass* or *Sole*, which

has one valve of a chesnut brown, the other valve milk white.

Most authors rank these Shells as a particular family, and call them *Pectens*. Gualtieri makes different genera of those with equal, and those with unequal valves; the former he calls *Pecten*, the latter *Concha Pectinata*; and the Escallops with unequal or single Ears he calls *Pectunculi*: Linnæus makes them a genus of *Oysters*, and has accordingly arranged them with, and by the names of *Oysters* in his 313th genus.

It is said, that Escallops will move so strongly as sometimes to leap out of the catcher wherein they are taken way: their of leaping, or raising themselves up, is by forcing their under valve against the body whereon they lie.

The chief kinds of fossil Escallops yet undiscovered, recent or living from sea, are as follow.

First. Size of the common Oyfter, with large but unequal ears, of a perfectly round contour ; the surface transversly thick set with prominent sharp thin ridges, like plates. The valves are equal. These are found very frequently in the quarries at Thame in Oxfordshire.

A second kind very elegant, about double the size of a Cockle, the valves unequal, one being quite flat, the other exceeding concave. It is thickly ridged length-ways with many common ridges and intermediate ones, that are very prominent or high, and the furrows are broad and deep. It is found in the quarries of Dorsetshire, Wiltshire, and the adjacent counties, as also sometimes in the chalk-pits of Kent and Surrey.

The second family is the Spondyli. The Spondyles are most generally eared Shells with unequal valves, rude or uncouth in shape, partaking of the ruggedness of the Oyster with somewhat of the Escallop form, so as to seem a medium between the two families. However, the Spondyles like the Escallops, have some species with equal valves, and without ears,

The head character is the hinge, which in the upper Shell consists of a triangular hollow and cartilage, like the Escallop, in the very center, on each side of which is a large deep cavity, and a very large thick and prominent tooth or joint lies on each side of the cavity. Pl. VI, fig. 4. *a*.

The summit and beak of the under valve is also extremely thick and strong, and extends from the hinge outwards into a broad triangular slope or flat.

Some

Some kinds of Spondyles are thickly and curiously set with long thorns or spikes ; these are generally, and very erroneously, called *Thorny Oysters*, and, when perfect, are greatly valued. Pl. VI. fig. 4.

This family is not very numerous in its species.

Lister, Woodward, Gualtieri, Linnæus, and Meuschen, all rank them as a particular genus, by the name of *Spondylus* ; but Rumphius, Argenville, Seba, and Davila, rank them very erroneously as *Oysters*.

The third family is the *Ostreum* or *Oyster*. The *Oysters* have unequal valves, though there are some species that have equal valves, but none are eared. The hinge of this family has not any teeth, but consists of one large inarticulate gutter running the length of the top of the Shell, in both Shells alike, and is covered
and

and filled with a strong cartilage, as in Pl. VI. fig. 2. *a*.

The species of this family are very numerous; some are curious though not beautiful, and bear a large price, as the *Hammer Oyster*, the *Cockscombs*, &c.

This family is ranked as a distinct one by all authors, but with many additions or omissions: as for example, Linnæus ranks the Escallops with them, and Argenville, and others the Spondyles, while Lister ranks the Hammer Oyster, and some others, as Escallops.

The fossil Oysters yet undiscovered recent or living from sea are very many; the chief of them are the *Gryphytæ* of fossilogists, of which there are several species; and a very large flat kind with equal valves, found in Shotover and Heddington quarries in Oxfordshire, Pl. VI. fig. 2.

The

The fourth and last family of Shells with unequal valves and that shut close, is the *Anomiæ*.

This family has long been known fossil, and contains a great number of species, all of which, except three or four, remain yet undiscovered recent or living from sea; and even these few known are discoveries made within these twenty years past.

Columna first mentioned some fossil species, and he being convinced that all fossil Shells were real exuviæ or spoils of animals, and not finding these described or noticed by Conchologists as Shells, called them *Conchæ rariores Anomiæ*; which word *Anomia* has since been so generally used for them, that it is now become the universal and established name of the family.

Columna

Columna described and figured some fossil kinds. Lister has also figured several in his Appendix de Conchitis to his *Historia Conchyliorum*; but no recent kind being discovered so early, is the reason that neither he, Buonanni, Rumphius, or other early authors, have taken any notice of them.

Woodward was the first who arranged the Anomiæ from the fossil Shells. He kept the established name, and ranked them with the Shells of unequal valves, and not eared; and further defined them to have both valves convex, and one of them beaked. He then arranged them into smooth, striated, and fulcated, each of which articles has several necessary subdivisions.

Woodward had only fossil Shells to inspect, consequently could not accurately define their peculiar interior structure, or their hinge; his definition however is
very

very just, except that he makes both Shells convex, which is not so in several species.

Gualtieri, who figures three recent kinds, Pl. XCVI. has made a particular genus for them, and calls it *Terebratula*. He defines them, very erroneously, as Shells with equal valves, and dissimilar sides, of a peculiar structure, for instead of a beak it has a perforation, and also has a very singular articulation or connexion within-side. The said author's figures are very good.

Linnaeus, who has enjoyed the discoveries of the recent or living Shells, has made them his genus 314 *Anomia*. He has mixed the recent with the fossil kinds, and defines them to be Shells with unequal valves, one valve being flattish, the other convex, the beak perforated, and the hinge inarticulate or toothless.

How-

However, he has much confused his genus and the species ; for he proposes the Gryphites, which, by all its characters, is a true Oyster, and the pellucid or glass Chinese Oyster, improperly so called, as species of *Anomia* ; besides many other inaccuracies.

As for Argenville, he figures the recent *Anomia lævis* very badly, and without any further reflection, places it among his Heart Cockles ; but, in his additional plates of the second edition, he gives a very good figure of the smooth kind.

But Mr. Davila treats them systematically, and as a genus of his first family or Oysters. He defines them as Shells whose beak or top of the under valve is perforated, and rises curved up on the upper valve. He does not however particularize any characters of the hinge, though he gives an excellent figure of the inner
 7 structure,

structure, or *appendices*, as he calls it, of one kind. Pl. XX. fig. *a*.

He also gives other figures in the said plate, but two of them, viz. D. and E. are not testaceous animals. He describes them, p. 311, & seq. in the following manner; the hinge of the under valve is composed of two small hooks, which are taken in or hinged into the sinuses or cavities of the upper valve, and it has two interior appendages fixed towards the top of the upper valve: this structure he observed in two species. In another species, the hinge was nearly the same, but had two long and narrow side appendages proceeding from the top of the upper valve, which extend themselves to the middle of it, where they are bound or stopped by two small ligaments, and then return again towards the top, in a very remarkable and curious manner, Pl. VI. fig. 7. And a third sort, (which is that of Gualtieri), has an interior appendage like to a perpendicular

pendicular gutter or pipe, fixed to the top, and running down to the middle of the upper valve.

I shall now give my definition, and characterise the genus as much as can be, for I hold it impossible to be accurately made till we discover more recent species; for those already discovered recent are few, and even differ in some particulars; and the fossil species, which are very numerous, never shew their inner structure, and so extremely seldom the hinge, that as yet we cannot fix any characters with accuracy.

I shall therefore, under these circumstances, define the *Anomiæ* as follows, Bivalves with unequal valves and never eared, the beak of the largest or under valve is greatly produced, and rises or curves over the beak of the smaller or upper valve, and is perforated or pierced through like
a tube

a tube, from which particular they have also obtained the name of *Terebratulæ*. The hinge is inarticulate or toothless, and they have always a remarkable interior structure. Pl. VI. fig. 3. *a*.

However, by what observations can be made, some of the fossil kinds have an evident multarticulate, or many-toothed hinge. Pl. VI. fig. 10.

I am therefore led to conclude, that the valves of the Anomiæ are connected together in two ways, instead of being only inarticulate, viz. 1. By an inarticulate hinge; and 2. By a multarticulate hinge.

The first set have no teeth or joints on the hinge; but the smaller or upper valve is always indented into a wide sinus, or opening of the larger or under valve, in which it plays like a joint, when the exigencies of the animal requires opening or shutting. Pl. VI. fig. 3. *a*.

The second set have a visible and regular multarticulate hinge; exactly like that of the Noah's Arks, or the multarticulate Cockles. Pl. VI. fig. 10.

On a due consideration of the deep grooves, the indentings, the undulated margins, and other distortions of these Shells, more than in any other genera, and by the beak, which is perforated or tubular quite to within the Shells; I am apt to imagine these animals seldom open their Shells, as most others do, to take their food; but nourish themselves through the tube or perforated beak only.

By the observations made on the few species lately discovered recent, this my opinion stands in some manner confirmed, as the living Anomiæ have all been found lurking in the nooks between the branchings of corals, or cavities of rocks. They lie therein lifted upon their flat surfaces
or

or horizontally, without any prop or solid body to rest on, but are upheld or sustained only by a strong adhesion of their tubes or perforated beaks to the sides of the cavities, as if in the action of sucking; and this position is the general one of the recent kinds*.

The interior structure of one of the recent kinds seems also not at all particularly adapted to the especial use of opening the Shells. It consists of a gristly or boney thin string, which twists in and out to above half-way within the Shells, like the

* I believe the hole in the beak of the *Conchæ Anomiæ* is for the purpose of transmitting a strong Ligament or gristly substance, by which they adhere firmly to the rocks, corals, &c. in the same manner as that class of Shells commonly called Bears Paws; at least some species of them have an opening between the two valves on one side the hinge, through which passes, from the inside of the Shells, a strong ligament, whereby the fish adheres firmly to rocks, corals, &c. I have seen this species of Shell sticking in this manner to coral.

twistings of Ribbands, vulgarly called *True Lovers Knots*. This is the second fort mentioned by Davila. Pl. VI. fig. 5. The other structure, which is Davila's third fort, is a guttered triangular appendage, with a cut or fent half-way down it, fixed perpendicularly on the upper valve, from the top or beak, to the middle of the Shell.

I have been very prolix on the *Anomiæ*, in order to establish what characters I could to form, if possible, a proper definition of this curious genus of Shells.

A very surprizing and unaccountable circumstance, relative to the fossil and recent testaceous animals, which has been already noted, is, that all those found in immense quantities in the fossil state, are hardly known recent, and *vice versa*. I instanced it in the *Ammonia*, that are found in incredible quantities fossil all over the world, though none are yet discovered recent; and this family of *Anomiæ*, though also found fossil in an astonishing abundance

dance, has very few recent species yet discovered.

But to conclude, from what has been abovementioned, I shall divide this family of Anomiæ into two genera, to wit, Genus 1. Inarticulate Anomiæ, or those in which the hinge of the under valve is a large sinus or cavity, the corners whereof form two prominencies or joints; and the upper valve is indented into it by a correspondent prominency to the cavity, and by two small hollows, answerable to the two prominencies or joints. Pl. VI. fig. 3.

Genus 2. Multarticulate Anomiæ, or those whose hinge lies on a long straight line, and is set with many teeth, exactly like the Noah's Arks. Pl. VI. fig. 10.

Pl. VI. fig. 3. shews the recent *Terebratula*, which is also found in very great quantities in the fossil state; the fig. 3. *a.* shews the top of the under valve, and its perforation.

Pl. VI. fig. 7. shews the under Shell of another kind, with its gristly appendages; lately discovered recent or living.

Pl. VI. fig. 10. shews a large fossil kind with a multarticulate hinge, not yet discovered recent or living.

I now proceed to Part II. or Shells that have equal valves, and shut close; such as the Cockles, Tellens, Muscles, &c.

I shall subdivide this Part into three Sections, viz. 1. Multarticulate, or with a great number of teeth on the hinges. 2. Articulate, or with few teeth: and 3. Inarticulate, or without any teeth.

Part II. Section 1. Leptopolyginglymi, or multarticulate Shells.

The multarticulate Shells give us three families, viz.

Family

Family 5. *Pectinoïdæ*, or Shells with equal valves, generally very flat; the hinge lies on a streight line like the Escallop, but is set with several parallel and strait ridges and intermediate furrows, and the sides are dissimilar. Pl. VI. fig. 6.

There are few species of this family. Lister ranks the two kinds he figures, Lib. iii. Part I. Sect. i. cap. 3. by the name of *Pectines Margaritiferæ Polyginglymi*. Woodward, among his *Pectunculi Leptopolyginglymi figura oblonga*, Class 3. Sect. 1. Art. 2. Gualtieri, Pl. 97. A. figures a kind, and calls it *Concha Longa Brachiata*; and Seba, Pl. 91. figures some among the *Pinnæ*, and calls them *Volfella*: but I cannot find them methodized in any other authors.

There is a very large and extremely thick species of this family, not yet kown recent, found fossil at Bononia in Italy,

which is fully described and figured in the memoirs of the Bononian Institute*.

Family 6. Pectunculi Polyginglymi, or multarticulate Cockles. The Shells of this family resemble the Cockles in all respects except the hinge; which in these is furnished with a great number of teeth, and in those with but few. Pl. VI. fig. 9.

This family has not many species.

The rank the multarticulate Cockles hold in Lister is Lib. iii. P. II. Sect. 2. cap. 2 and 3, or Pectunculi Leptopolyginglymi margine rotundâ. Woodward ranks them in Art. 2. of Sect. 1. of Class 3, also on the same account of their being of a roundish shape (*figura subrotundâ*). Linnæus places them in his 312 genus of Arca; and the other authors have mixed

* De insigni quodam Ostreo, & Josephi Montii de Ostreo fossili magnitudine & figura insigni. Commentarii Instituti Bononienfis. Vol. II. P. I. p. 71. Vol. II. P. II. p. 339, cum fig.

them indiscriminately with the articulate Cockles.

Family 7. *Arcæ*, the Arks or Boats, such as have their hinges on a perfect straight line, and are of a somewhat squarish figure or oblong; as the Noah's Arks and square Cockles.

The rank the Arks hold in Authors is: Lister puts some kinds among the multarticulate Cockles, *Lib. iii. P. II. Sect. 2. cap. 1.* and the Noah's Arks he places among the Muscles, as many-toothed Muscles, *Ibid. Sect. 6. cap. 2.* Woodward ranks them among his *Polyginglymi formâ oblongâ*, or with family 5. *supra.* Argenville places them in his fourth family, or of Heart Cockles; but Davila makes them a distinct genus of his fourth family, or Heart Cockles, and calls them Arks. Gualtieri forms a genus of them by the name of *Concha Rhomboïdalis*: and Linnæus and Meuschen rank them as a distinct genus, and call them *Arca*.

This

This family has not many species.

To this family of Arks I imagine the fossil *Hippocephaloidæ* belong, and that they are species of it, yet undiscovered recent or living from sea : my reason for ranking them with the Arks, and not the Cunei, is, that they appear to me to be multarticulate Shells.

Part II. Sect. 2. comprehends all Bivalves with equal valves, that are not eared, and have few teeth upon their hinge.

This section is extremely numerous, and very confused in authors. I shall therefore proceed first with the eighth family of Pectunculi or Cockles, whose character is a curved or semilunar hinge set with two to four strong teeth. Pl. I. fig. 8, 9, 14. Pl. VI. fig. 8, 12. Pl. VII. 1, 2, 3, 10, 11.

This family of Cockles is so extremely numerous, and besides has such striking or
remarkable

remarkable subordinate characters, that it can, with great propriety and ease, be divided into three genera, viz.

Genus 1. Pectunculi or Cockles, the Chamæ of some later authors. Pl. VII. fig. 1.

Genus 2. Cordiformes or Heart Cockles. Pl. I. fig. 8, 9. Pl. VI. fig. 8. And

Genus 3. Truncati or flat-sided Cockles. Pl. VI. fig. 12. Pl. VII. fig. 10.

Genus 1. Pectunculi or Cockles. Shells convex or flattish, of a roundish shape, and with similar or dissimilar sides; whose beaks are not very peaked or prominent, and curve, or turn much upwards towards the hinge; such are the flattish Cockles, and many others. This genus is numerous.

Lister intermixes them with my two following genera, all by the name of Pectunculi,

tunculi, and he has also placed several among his Tellens. Argenville, Davila, and Meuschen call them Cames; and Davila divides them into [four genera. Gualtieri also calls them Chamæ; and Linnæus disperses them into several of his genera.

Genus 2. Cordiformes, or Heart Cockles, are such Cockles whose beaks are very prominent, and curve up greatly towards the hinge, thereby forming a figure perfectly like a heart, as vulgarly painted.

This genus is pretty numerous. Lister intermixes them with the others. Argenville makes them his fourth family, Cœurs or Boucardes. It is also Davila's fourth family, who calls them Cœurs, and divides them into three genera, of which only the first is this my genus. They are the twenty-eighth genus of Meuschen. Gualtieri places them among his Conchæ Cordiformes: and by Linnæus they are ranked in his Cardium genus.

Genus

Genus 3. *Truncati* or flat-sided Cockles. These are such Cockles as are truncated, or have one side flat, and, as it were, cut off. These species rank in most authors with the Cockles in general; and Davila only, to my knowledge, has made a particular or distinct genus of them: it is his third genus of Hearts, which he calls *Cames Tronquées* ou *Conques de Venus*. This genus is not very numerous.

Family 9, is the *Tellinæ* or *Tellens*; Shells more broad than long, rather flat, and the hinge has two teeth set close together. Pl. VI. fig. 11, and 11. *b*.

This family may be divided into two genera, viz.

Genus 1. *Tellinæ*; Shells with similar sides, whose beak and hinge are central, Pl. VI. *f*. 11.

Genus 2. Cunei ; Shells with dissimilar or unequal sides, whose beak and hinge are placed near to, or quite at one end.

Genus 1. Tellens. It is not very numerous in its species. The rank it holds in authors is as follows : Lister places them after the Pinnæ. Lib. iii. P. 2. Sect. 8. and defines them Shells shaped like wedges. Woodward makes a genus of them, and says they have few teeth on the hinge, and are oblong Shells or with lengthened sides : he might have expressed himself better by saying they were broad Shells. Rumphius, Gualtieri, Linnæus, and Meuschen, have all a genus they call Tellina ; Davila also, but he defines them very inaccurately, and includes the Solens as a genus of them. As for Argenville, he ranks them among the Muscles.

In regard to the second genus, or Cunei, they are intermixed by authors among the Tellens.

There

There are several kinds of fossil Cunei, which remain yet undiscovered recent or living from sea ; and some are very elegant and curious : as for example, the studded kind, Pl. VI. fig. 5. the reticulated, and the fulcated Cunei, &c.

Family 10. Placentæ; Shells with equal valves, whose hinge or cardo lies quite within the Shell, and in one valve consists of two strait linear ridges, pretty prominent, and laid obliquely to each other, so as to meet at one end in a very acute angle ; and the other valve has two correspondent furrows. Pl. VII. fig. 13.

I know of but two species of this genus, to wit, the *Chinese Glass* or *Pellucid Oyster*. Pl. VII. fig. 13. and the *Polish Saddle*.

I am the first who has formed this genus ; for Lister places the Glass Oyster as an *Escallop*, Linnæus as an *Anomia*, and others

as

as an Oyfter ; and the Polish Saddle by all authors is ranked as an Oyfter.

I now proceed to Section 3, or those Bivalves that are inarticulate, or have no teeth on their hinge ; as the *Margaritiferæ*, Muscles, &c. Pl. I. fig. 13. Pl. VII. fig. 9, 14, and 15.

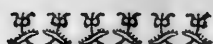
Family 11. *Margaritiferæ*, or Pearl, Oyfters, are eared Shells with equal valves, and their hinge is meerly a gutter or slight furrow, without a single tooth. Pl. VII. fig. 14.

The species of this family are few : they are the Mother of Pearl Shells or Pearl Oyfters, the Swallow, &c. I have made a distinct genus of them ; but Lister calls them Pearly Escallops : Rumphius, Davila, and Meuschen, rank them as Oyfters. Woodward forms a genus he calls *Margaritiferæ* ; and defines it as eared Shells with a smooth hinge ; and Gualtieri defines them by placing the Pearl Shells in

one genus, by the name of *Conchæ Inæquilateræ*; and the Swallow in another genus he calls *Conchæ Aliformes*.

The last and twelfth family of Bivalves with equal valves, is the muscles; they are not eared; are most generally very convex, of a long and narrow shape, and the hinge is a meer slight furrow without any tooth, and is situated not at the top of the Shell, but a little way down one of the sides.

The species are not many; and this genus is universally agreed upon by authors.



SECTION XIII.

I AM now come to Part III. *Conchæ Hiantes*, or Bivalves, whose Shells never shut close, but are always open or gaping in some part.

This part constitutes the thirteenth family, and consists of four genera, to wit,

Genus 1. *Tridacnæ*, or Bason Conques.

Genus 2. *Chamæ*, or Gapers.

Genus 3. *Solens*, or Sheaths : and

Genus 4. *Pinnæ*, Sea Wings, or Hams.

Genus 1. *Tridacnæ*, or Bason Conques. Shells of equal valves and dissimilar sides, in hinge and appearance like the Heart
 3 Cockles,

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Cockles, but on the longest side, from the beak to near the extreme margin, the two Shells do not close, but leave a large oval or heart-like gap or opening, the lips whereof are very broad, and turn up on the edges. Pl. VII. fig. 4, 5*.

These are the *Bafon Conques*, &c. of which there are few species: but they are the largest and heaviest Bivalves yet known, some weighing from three hundred and a half to six or seven hundred weight.

Genus 2. *Chamæ*, Purrs or Gapers. .
The *Chamæ* have a broad, thick, and large tooth for their hinge, and are, as it were, abruptly cut off on one side, which side is always open or gaping, as the valves

* I think some distinction should be made between these and the *Chamæ*. The Apertures in the first are meerly to transmit a *fine tentaculum*, to prevent their being dashed to pieces by the rocks and waves. The *Hiatus* in the *Chamæ* is for a very different purpose, to permit the fish to extend itself in search of food, and immediately to retire in cases of danger.

cannot shut close at that part. Pl. VII. fig. 16.

The name of Chama, notwithstanding its signification of a gaping or open body, has of late years been very erroneously applied to Shells which always shut close, as the Cockles, &c. *

There are very few species of this genus.

Genus 3. Solenes, Sheaths, or Razor Shells. These are very broad, though extremely short. They are open at both ends; and the hinge has teeth placed quite at one end. Pl. VII. fig. 8.

There are very few species of this genus.

Genus 4. Pinnæ, Sea Wings or Hams. The Pinnæ are Shells of a somewhat tri-

* Chamæ à Græcis Χύμαί nominatæ sunt ab hiando, propterea alii illas etiam *Hiatulas* vocarunt.

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angular shape, widening from a pointed or narrow top to a very broad end, which broad end is always open. The hinge is inarticulate, and is placed on one side.

The species of this genus are few.



SECTION XIV.

THE third general division of testaceous animals is the Multivalves, or those Shells that are made up of many valves or pieces. There are three families in this division, viz.

Family 14. Pholas, or Piddocks.

Family 15. Anatiferae, or Barnacles: and

Family 16. Balani, or Acoïns.

Family 14. Pholas or Piddocks. These Shells are trivalves, and have two large valves, with a small valve placed between them, near to the hinge. The hinge turns up on the outer part of the Shell, and under it, within the Shell, is a long curved tooth or spur. Pl. VII. fig. 17.

The species of this family are very few.

Family

Family 15. *Anatiferæ* or Barnacles. These Shells are quinque-valves, and are made up of two large valves with two small ones beneath them, and a long narrow spur-like valve, which connects them, and runs lengthwise. Pl. I. fig. 11. *m*. The neck or cartilage it hangs by. *o* The spur-like valve; and *p*, the smaller valves.

There are but few species of this family.

The Latin name *Anatifera* was given them from the fabulous story of their becoming geese; as was also the English name *Barnacle* from the same origin, as those birds they were supposed to breed were the *Barnacles* or *Brent Geese*.

The sixteenth and last family of Shells is the *Balani* or Acorns. The *Balani* are made up of many valves lying parallel to each other, and in a perpendicular position, contrary to the position of all other valves, which lie horizontally. The top is open,

and the fish performs its necessary functions by that aperture; for the valves never open or separate, as they have no hinges. The bottom is the part by which they affix themselves to other bodies; for the Balani are never found loose, or otherwise than affixed to shells, stones, and other solid bodies. Pl. I. fig. 12. Pl. VII. fig. 6, 7.

There are few species of this family.

There is another set of marine animals called *Oscabiorns*, which though their covering is like Shells, yet I cannot agree to rank them as testacea, for I think, like the Echini, they are genera of crustaceous animals. However, Argenville, Adanson, Linnæus, and Davila, rank them with Shells; I shall nevertheless keep to my opinion for the present, and pass them over with only observing, that, if the collector thinks they are testacea, with the authors above quoted, the rank they will hold is in this division, and that they will form a seventeenth family.



EXPLANATIONS OF PLATES.

PLATE I.

Fig. 1. **P**ATELLA vulgaris, the common Limpet in profile, to shew the simple Univalves. *l.* the eye or apex.

2. Inside of the same in full view.

3. Buccinum Vulgare Anglicum, the common English Whelk in full view, or on the side of the aperture.

4. The same on the back part.

5. The same cut open to shew the interior structure. *a.* The body. *b.* A single wreath. *c.* The turban, or assemblage of wreaths. *d.* The Columella or pillar; and *e.* The beak, or rostrum.

6, 7. A Spider Shell, or Aporrhais, in full view, and on the back part. *a a.* The body. *b.* A wreath. *c.* The turban or clavicle. *e, f, g.* The lip. *h.* The rostrum, beak, or top. *i. i.* The sinus or scoop. *k.* The prongs, or claws.

8, 9. A large Cockle, shewn inside and outside, to exhibit Bivalves of equal valves, and that always shut close.

10. Two *opercula*, or lids of Univalves; the largest is the *Blatta Byzantia*.

11. An Anatifera, or Barnacle, a Quinquevalve. *m.* The neck, or gristly appendage to which the Shell is affixed. *o.* The long, narrow, spur-like Shell, that is the fifth valve, and lies in a transverse position to the other four valves, of which *p.* are the two smaller.

12. A group of common Balani, or Acorn Shells, which are Multivalves.

13. Cardo

13. *Cardo Edentulus* of a Bivalve. An inarticulate hinge, or without any teeth.

14. *Cardo paucis dentibus*. A hinge set with few teeth.

15. *Cardo dentibus numerosis seu polygymon*. A multarticulate hinge, or set with numerous teeth.

P L A T E II.

Fig. 1. **P**ATELLA *Oculus Hirci*. The Goat's Eye Limpet, taken from the anonymous new Conchology. Tab. 2. fig. 6. p. 11. N^o. 6.

2. Patella Concamerata. A chambered Limpet from ditto. Tab. 6. fig. 1. shewn inside and outside.

3. A Mask Limpet from Falkland island, from ditto. Tab. 7. fig. 5.

4. An Auris Marina, or Sea Ear,

5. A chambered Vermiculus, taken from Davila's Catalogue. Tome I. Pl. 21.

6. A group or cluster of common Vermiculi, from anonymous new Conchology. Tab. 10. fig. 17.

Fig. 7.

Fig. 7. A single Vermiculus, or Worm-tube, from anonymous new Conchology. Tab. 10. fig. 15.

8. Penecillus. The *Watering-Pot*.

9. The green fulcated Indian Dentale, or *Elephant's Tooth*. New Conchology. Tab. 12. fig. 12.

10. The common smooth English Dentale, from ditto. Tab. 10. fig. 3.

11. A Turbo Concameratus, in the fossil state, or a stone-cast.

12. A recent Orthoceratites from the shores of Rimini, in the Adriatic Sea, cut open, and greatly magnified. From Gualtieri Index Conchyliorum.

13. Shews the Shell of its natural size, from the same author.

Fig.

14. Fragment of a fossil Orthoceratites, in which the chambers and the siphunculus are distinctly shewn; from Breynius de Polythalamiis. Tab. 6. fig. 1.

15. An Ammonoides fossil.

16. The Pearly Chambered Nautilus, or Sailor, and

17. The same Shell cut open, to shew its internal chambered structure.

18. The Lituus or Rams Horn, and

19. The same Shell cut open, to shew its internal chambered structure.

20. An Ammonites fossil, and

21. The same laid open, to shew its internal chambered structure.

P L A T E I I I .

Fig. 1. **A** *COWRY* on the upper side.
Cyprea.

2. The same Shell on the under side, to
shew the mouth or aperture.

3. The *Weavers Shuttle*, Semiporcellana.

4. A *Dipper*, shewn on the aperture or
under side. Nux.

5. The same on the upper side.

6. The *Paper Nautilus*, Cymbium.

7. *Venus Ear*, on the upper side.

8. The same Shell on the under side,
or shewing the mouth or aperture.

9. *Cochlea Strombiformis*, five *Clavicula*
longissima.

Fig.

Fig. 10. Cochlea Helix vel depresso.

11. Cochlea Clavicula depresso, vel brevior.

12. Turbo five Cochlea clavicula productior. The *Snake*.

13. A Trochus.

14. The *Magpie* Nerit, Nerita on the upper side.

15. The same Shell shewn on the under or mouth-side.



P L A T E IV.

Fig. 1. **T**HE *Furbelow* from Falkland
Island; *Buccinum Fimbriatum*.
A *Buccinum* of the *canaliculated* kind.

2. The *Grimace*. A *Buccinum* of the
recurvirostrum kind.

3. The *Tiara* or *Papal Crown*. A *Buc-*
cinum of that kind with the *Pleated Pillar*;
Columella Dentata.

4. The *Crane*. A *Buccinum* of the *longi-*
rostrum kind.

5. The *Thorny Woodcock*. A *Purpura*,
and of the *longirostrum* kind.

6. The *Joppa Whelk*. A *Buccinum* of
the *umbilicated* kind.

U

7. A

Fig. 7. A Strombus or *Needle*.

8. A curious knobbed *Tun*, Globosa.

9. A *Melon Tun*, Globosa.

10. A *Helmet*, Cassis, shewn on the under or mouth side.



PLATE V.

Fig. 1. **A** MUREX of the Alata genus. A kind of *Plough*.

2. A Murex of the Rhombus genus.

3. A Volute. A kind of *Admiral*.

4. The *Panama* or *Camp*. An Olive or Cylindar.

5. A Murex. The *Devil*.

6. A Purpura, called the *Skeleton*.

7. An Olive or Cylindar.

8. A *flamboyante* Volute.

9. Another Volute. A kind of *Admiral*.



P L A T E VI.

Fig. 1. **T**HE *Ducal Mantle* Escallop.
 Fig. 1. *a.* shews the inside
 top or the hinge of the Shell.

2. The fossil Oyster, found at Hedding-
 ton in Oxfordshire. A species yet undis-
 covered recent or living. Fig. 2. *a.* shews
 the inside top or hinge.

3. The *Anomia Terebratula*, only of
 late years discovered recent or living. Fig.
 3. *a.* the top or hinge part of the shell.

4. A Spondyle, vulgarly called the *Thor-*
ny Oyster. Fig. 4. *a.* the inside top or the
 hinge.

5. The studded Cuneus, a fossil, of which
 the living species yet remains undiscovered.

6. A *Pectinoides*.

7. Fig.

FIG 7. The bottom valve of a species of *Anomia* lately discovered living, and shews the inside with the gristly appendages of the animal, taken from Davila's Catalogue. Vol. I, Pl. xx. fig. *a*.

8. A *Cardium* or Heart-Cockle, the *Strawberry*.

9. A *Polyginglymon* or Multarticulate Cockle.

10. A *Polyginglymon* or Multarticulate *Anomia*, fossil, of which the living species still remains undiscovered.

11. The *Tulip Tellina*, fig. 11. *b*. shews the inside top or hinge.

12. The *painted Cockle*, of the truncated or flat-sided kind.



P L A T E VII.

Fig. 1. { **A** PECTUNCULUS shewn
on the inside.

2. { And in two side views. *a. a.* the
3. { summit. *b. b. b.* the beaks. *c. c. c.*
the margins or borders. *d. d.* the
length of the shell. *e. e.* the
breadth of the shell. *f. f. f.* the
flopes.

4. A Tridacna, the *Basen Conch* or
Clamp.

5. The inside top or the hinge part of
the said Shell.

6. A Balanus or *Acorn Shell*. A Mul-
tivalve.

7. The same cut open to shew its in-
terior structure.

Fig.

Fig. 8. Solen, the *Sheath*, *Razor Shell* or *Spout-Fish*. A Shell of equal valves, but that never shuts close; a *Concha bians*; the line *d. d.* shews its length, and *e. e.* its breadth.

9. The Common Muscle. A species of the Shells with inarticulate hinges.

10. The *Bears Paw*, of the kind of flat-fided Cockles.

11. The inside top or hinge part of the said Shell.

12. The *Pearl River Muscle* shewn of the inside.

13. The *Glass* or *Chinese pellucid Oyster*, of the *Placenta* family, an inside view to shew the hinge.

14. The *Pearl Oyster* of the *Margaritifera* family, an inside view to shew the inarticulate hinge.

Fig. 15. Another figure of an inarticulate hinge.

16. A *Chama* Pholas, the *Spoon-hinge*, shewn on the inside, and is a *Conchabians*, or a Shell that never shuts close, but is always *open* or *gaping* at one end.

17. The *Spur* Pholas, also shewn on the inside.

TABULA SYNOPTICA TESTACEORUM. I. UNIVALVIA.

Testaceous Animals rank under Three general Divisions; viz. I. Univalves. II. Bivalves. III. Multivalves.

DIVISION I. UNIVALVES have Four Orders or Subdivisions. I. Simple. II. Chambered. III. Revolved; and IV. Turbinated, or Spiral.

ORDER I. Simple, or no-wise Spiral.

ORDER II. Polythalamia, or Chambered.

FAM.	GENUS.	FAM.	GENUS.
I. Patella. Limpets.	1 Vertice integro, whole Limpets.	V. Polythalamia.	8 Orthoceros. Horns.
	2 Concamerata, chambered Limpets.		9 Lituus. Croziërs.
	3 Vertice perforato, Marks.		10 Turbinoides.
II. Haliotis. - -	4 Sea Ears.		11 Ammonia. Snakes.
III. Vermiculi. - -	5 Worm Shells.		12 Ammonoides.
	6 Penicilli.		13 Nautili. Sailors.
IV. Dentalia. - -	7 Teeth.		

ORDER III. Revolved.

ORDER IV. Turbinated; or Spiral.

FAM.	GENUS.	FAM.	GENUS.	FAM.	GENUS.
VI. Turbinata in- voluta.	14 Nuces five Bullæ, Dippers.	VII. Cymbium.	17 Paper Nautilus.	XV. Buccina.	30 B. Canaliculata, guttered, <i>W</i> .
	15 Semiporcellana.	VIII. Auris Cochlea.	18 Venus Ear.		31 B. Recurvirostra, wry-mouthed, <i>W</i> .
	16 Cyprea vel Porcellana. Cowries.	IX. Cylindri. - -	Olives, or Cylindars.		32 B. Longirostra, vel rostrata, beaked, <i>W</i> .
		X. Voluta. - -	19 Emarginati.		33 B. Umbilicata, umbilicated, <i>W</i> .
		XI. Globosa. - -	20 Marginati.		34 B. Columella plicata, <i>W</i> .
		XII. Cassides. - -	21 Volute.		with a pleated pillar.
		XIII. Trochi. - -	22 Tuns.		35 Strombi, Needles.
		XIV. Cochlea. - -	23 Helmets.	XVI. Murex.	Rocks.
			24 Tops.		36 Murex, Rocks.
			Snails.		37 Rhombi, Lozenges.
			25 Nerits.		38 Alata, Winged Rocks.
			26 Helices.		39 Aporrhaidæ, Fingered Rocks.
			27 C. Clavicula brevior.		or Spiders.
			28 Turbo.		
			29 Strombiformes.		

TO THE HONORABLE
MEMBERS OF THE HOUSE OF REPRESENTATIVES
IN SENATE CHAMBERS
WASHINGTON, D. C.
JANUARY 1, 1901
SIR:
I have the honor to acknowledge the receipt of your letter of the 29th inst. in relation to the matter of the proposed amendment to the Constitution of the United States, and in reply to inform you that the same has been referred to the Committee on the Judiciary, and that they are now considering the same.

Very respectfully,
J. H. HARRIS,
Clerk of the House of Representatives.

TABULA SYNOPTICA TESTACEORUM. II. & III. BIVALVIA and MULTIVALVIA.

DIVISION II. BIVALVES have three Orders or Subdivisions.

I. With unequal Valves, and shut close. II. With equal Valves, and shut close ; and, III. With Valves that never shut close.

ORDER I. With unequal Valves, and shut close.

FAM.	GENUS.
I. Pecten. - - -	1 Escallops.
II. Spondylus. - -	2 Spondyles.
III. Ostreum. - - -	3 Oyster.
IV. Anomia. - - -	Anomia.
	4. A. Inarticulate.
	5. A. Multarticulate.

ORDER II. with equal Valves, and shut close.

Sect. I. Leptopolyglymyi, or Multarticulate.

FAM.	GENUS.
V. Pectinoides. - - - - -	6 Pectinoides.
VI. Pectunculi Leptopolyglymyi.	7 Multarticulate Cockles.
VII. Arca. - - - - -	8 Ark, or Boat.

Sect. II. Articulate, or set with few Teeth.

VIII. Pectunculus. - - - - -	Cockles.
	9 Cockles.
	10 Cardium, or Heart Cockles.
	11 Truncatus, or flat-sided Cockles:
	Tellens, or Sand Muscles.
IX. Tellina. - - - - -	12 Tellens.
	13 Cuneus.
X. Piacenta. - - - - -	14 Placenta.

Sect. III. Inarticulate, or without any Teeth.

XI. Margaritifera. - - - - -	15 Pearl Oyster.
XII. Musculus. - - - - -	16 Muscles.

ORDER III. with Valves that never shut close. Conchæ Hiantes.

XIII. Chama, Gapers. - - - - -	17 Tridacna, Bafon Conques, or Clamps,
	18 Chama, Purrs.
	19 Solen, Sheath, or Razor Shell.
	20 Pinna, Sea-Wing, or Ham.

DIVISION III. MULTIVALVES.

FAM.	GENUS.
XIV. Pholas. - - - - -	21 Piddocks.
XV. Anatiferae. - - - - -	22 Barnacles.
XVI. Balani. - - - - -	23 Acorns.

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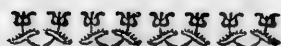
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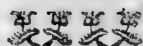
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- | pag. | lin. |
|------|--|
| 97. | <i>Catch word, being read signifying</i> |
| 98. | 22. roll <i>r.</i> rolled |
| 101. | 17. <i>after</i> shells, <i>add</i> which |
| 112. | 12. the base end <i>r.</i> the base, end or |
| — | 15. or end the, <i>r.</i> or end, the |
| 153. | <i>title.</i> Section VIII. <i>r.</i> VII. |
| 159. | 2. in the note. Sect. 401. <i>r.</i> Sect. 4. c. 1. |
| 160. | 10. 11. fig. 18. is the entire shell, and fig. 19. is cut open.
<i>r.</i> fig. 19. is the entire shell, and fig. 18. is cut open. |
| 166. | penult. l. duo sfulcos <i>r.</i> duos fulcos |
| 186. | 17. <i>after</i> nimbly, <i>add</i> a comma |
| 189. | 1. shells <i>r.</i> species |
| 190. | 2. c. 1. and 5. <i>r.</i> c. 1. a 5. |
| 204. | 8. <i>after</i> ear, <i>dele</i> comma |
| 207. | 5. <i>after</i> strombiformis <i>dele</i> comma |
| 242. | 7. <i>after</i> Pl. I. fig. <i>add</i> 13, |
| — | 14. (fulcus Canaliculus) <i>add</i> commas to each word, |
| 245. | 14. <i>dele</i> the comma <i>after</i> coral |
| 246. | 16. are taken way; their of leaping <i>r.</i> are taken;
their way of leaping |
| 257. | 13. inartilate <i>r.</i> inarticulate |
| 272. | last line, defines <i>r.</i> divides |
| 283. | l. 5. 6. polygymon <i>r.</i> polyginglymon |
| 284. | penult. l. annoymous <i>r.</i> anonymous |
| 286. | fig. 18. <i>r.</i> 19. and fig. 19. <i>r.</i> 18. |
| 287. | 5. femiporcellanea <i>r.</i> femiporcellana |

What other Errata occur, the candid Reader is desired to correct.

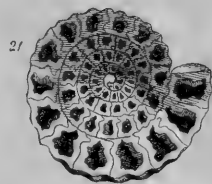
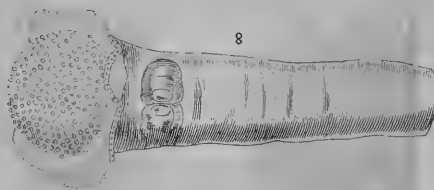
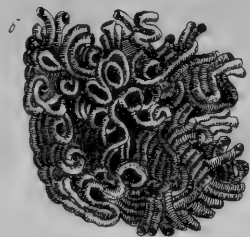
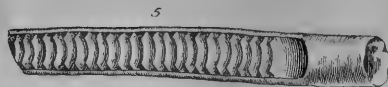
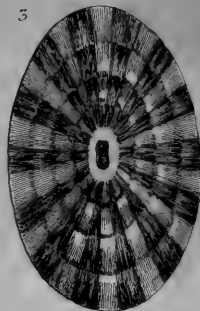
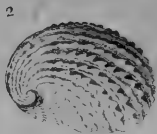
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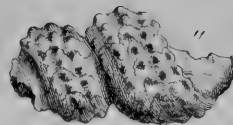
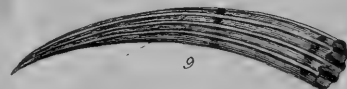
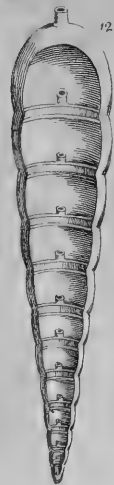
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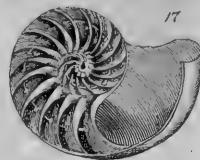




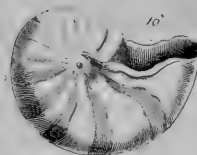
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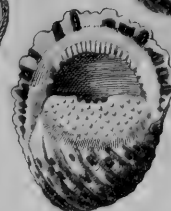
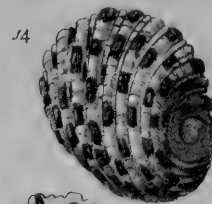
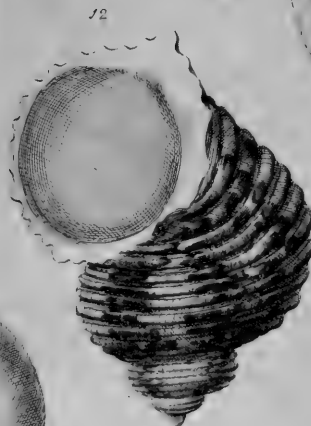
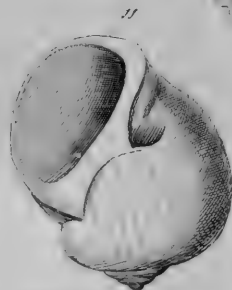
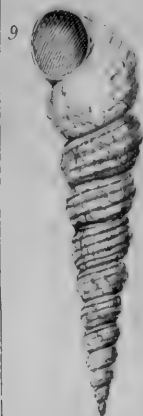
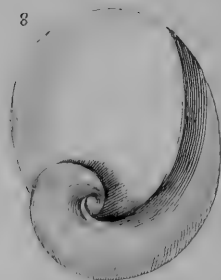
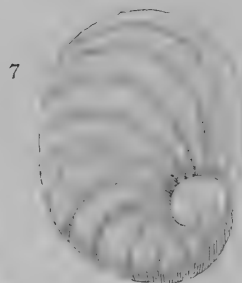
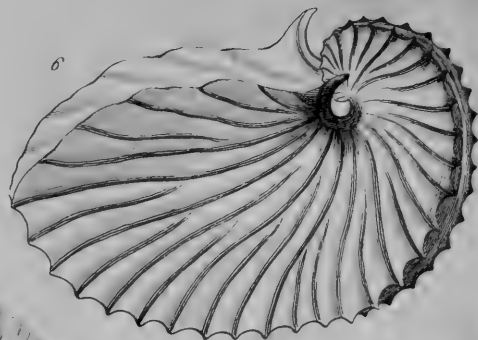
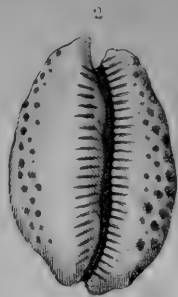


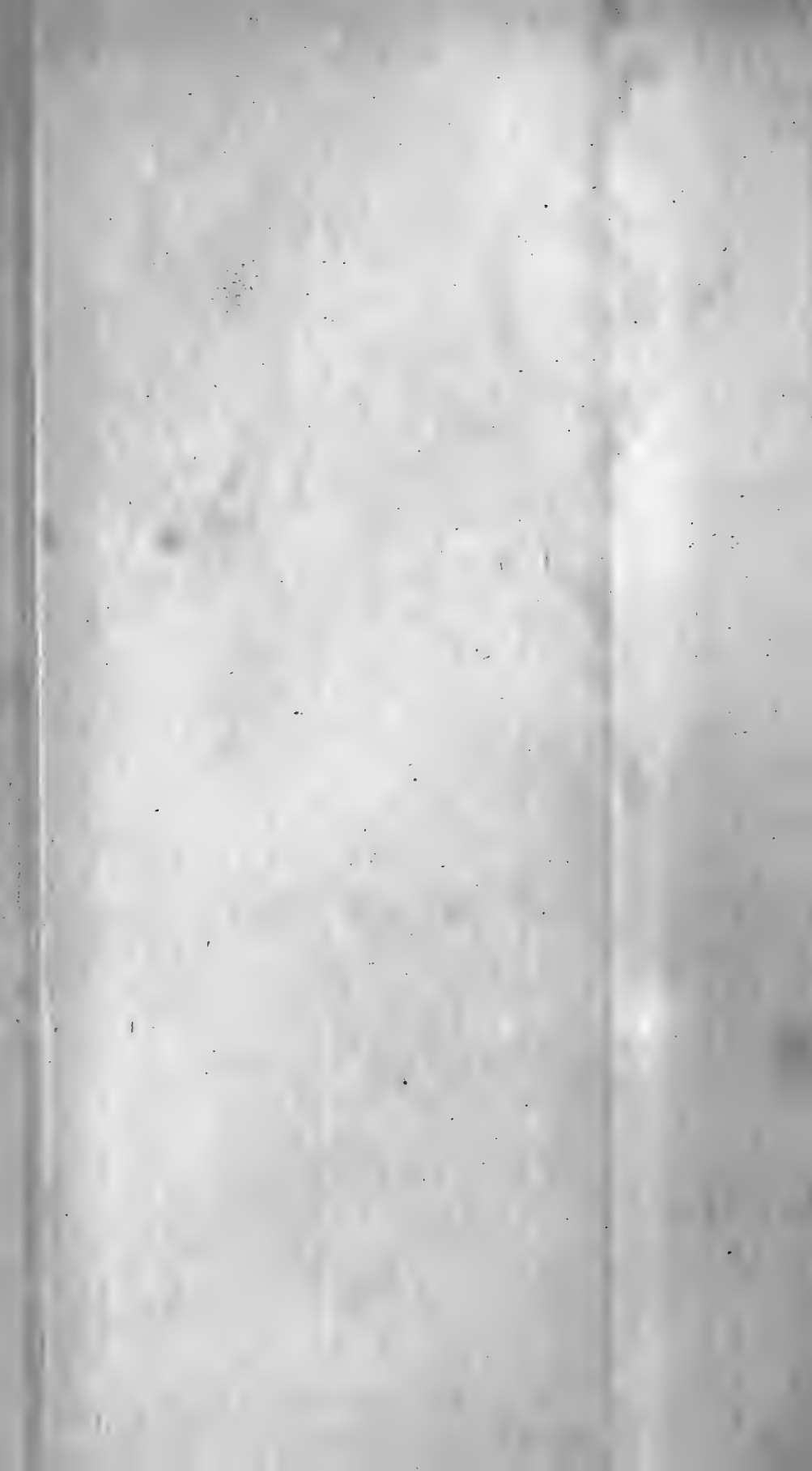
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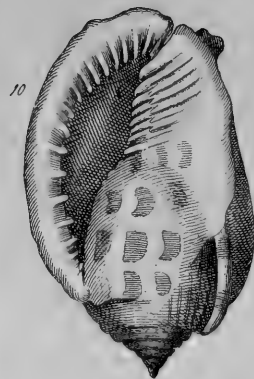
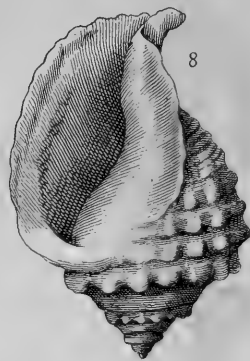
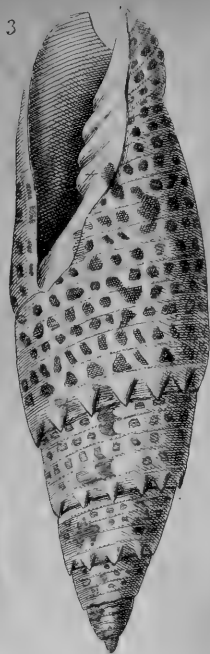
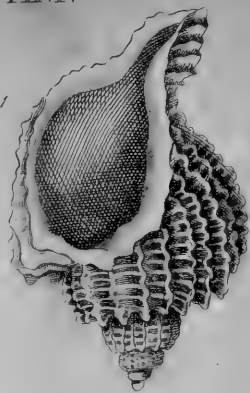


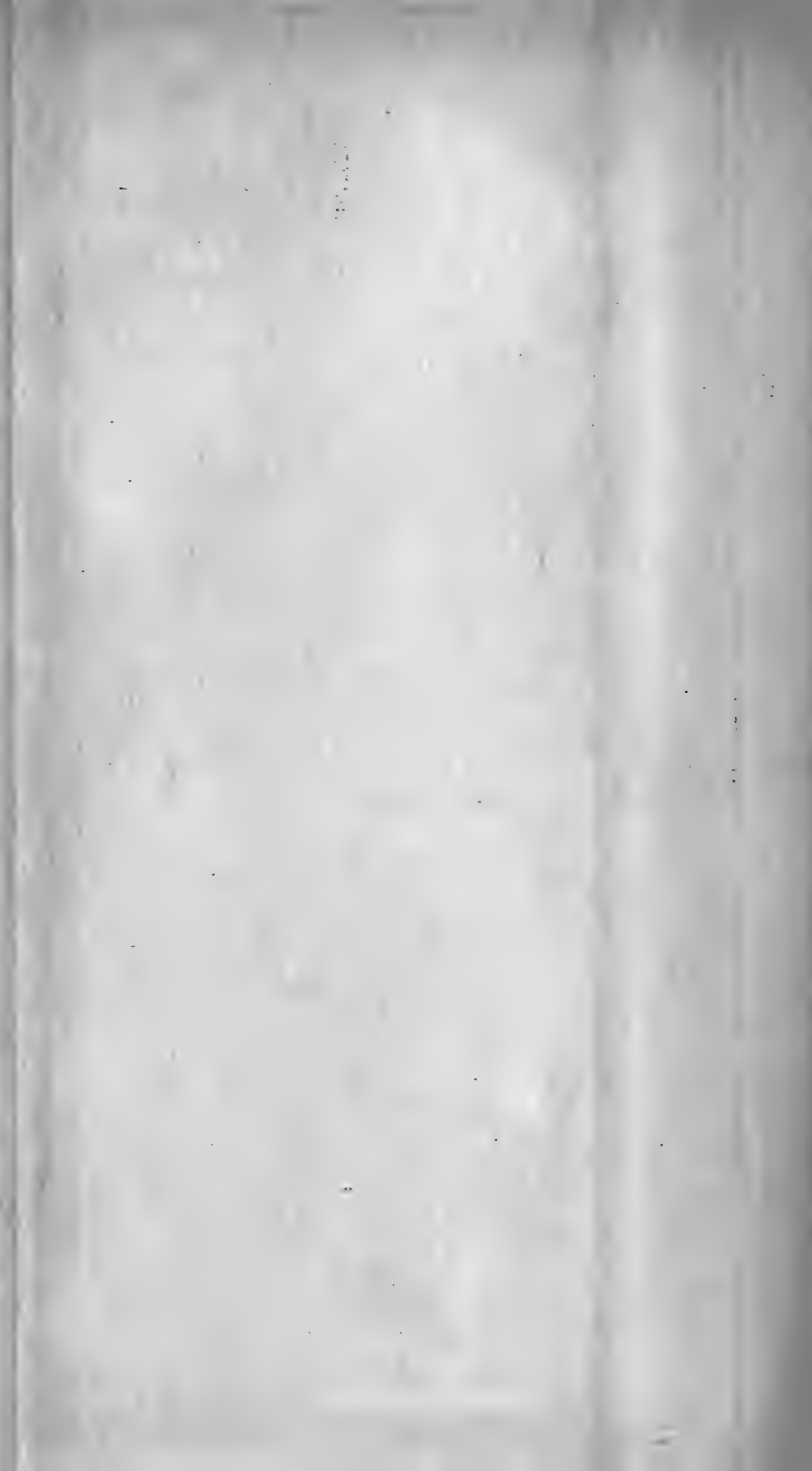
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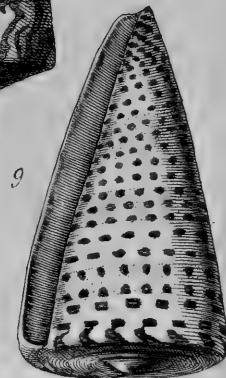
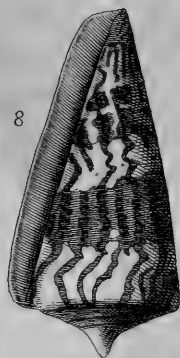
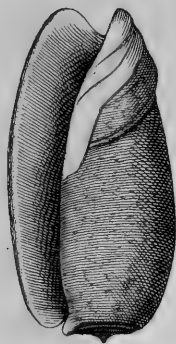
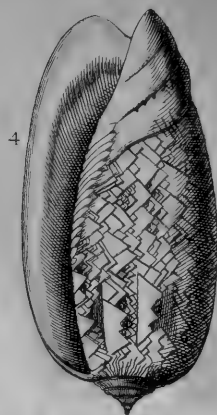
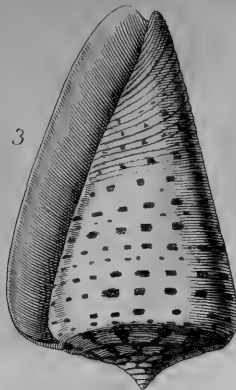
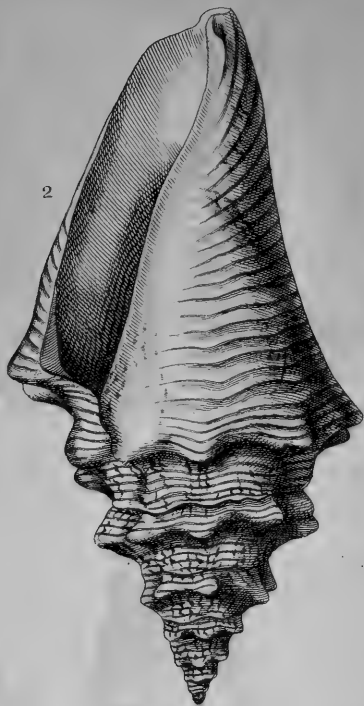
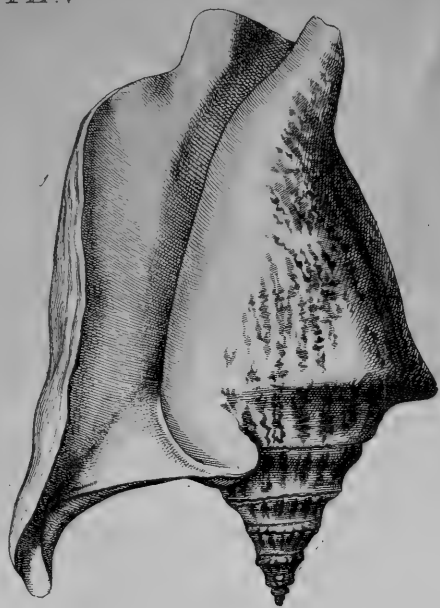


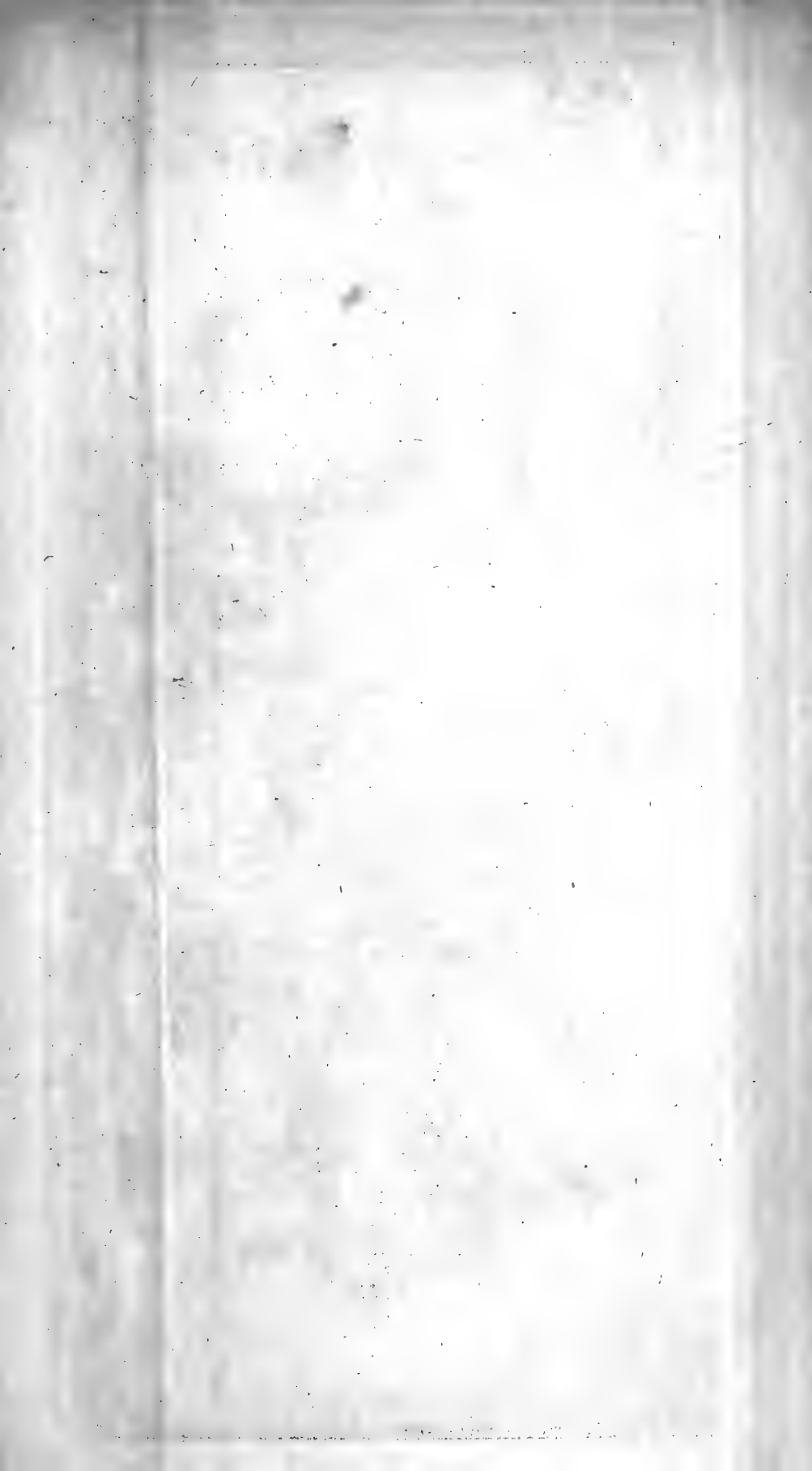




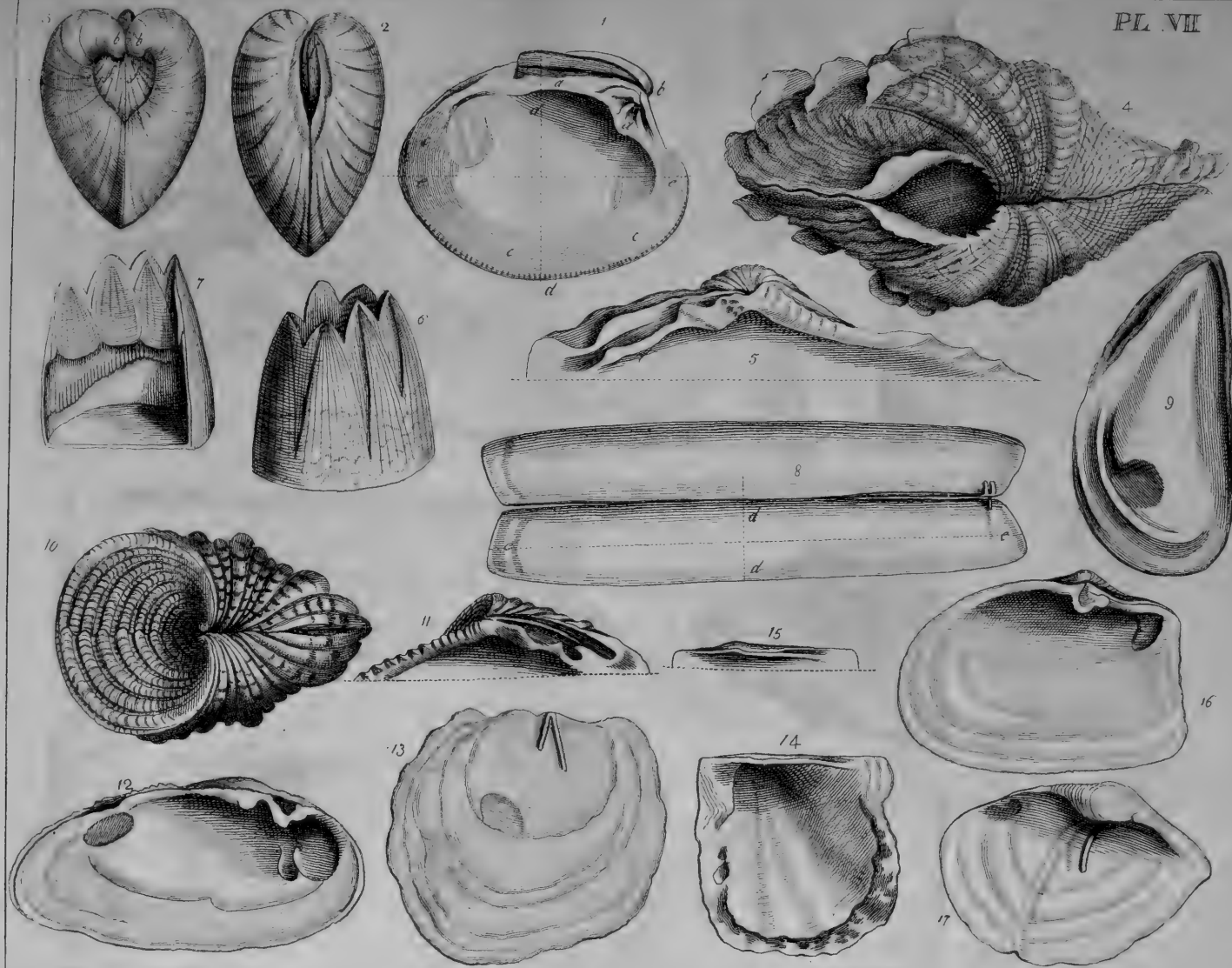


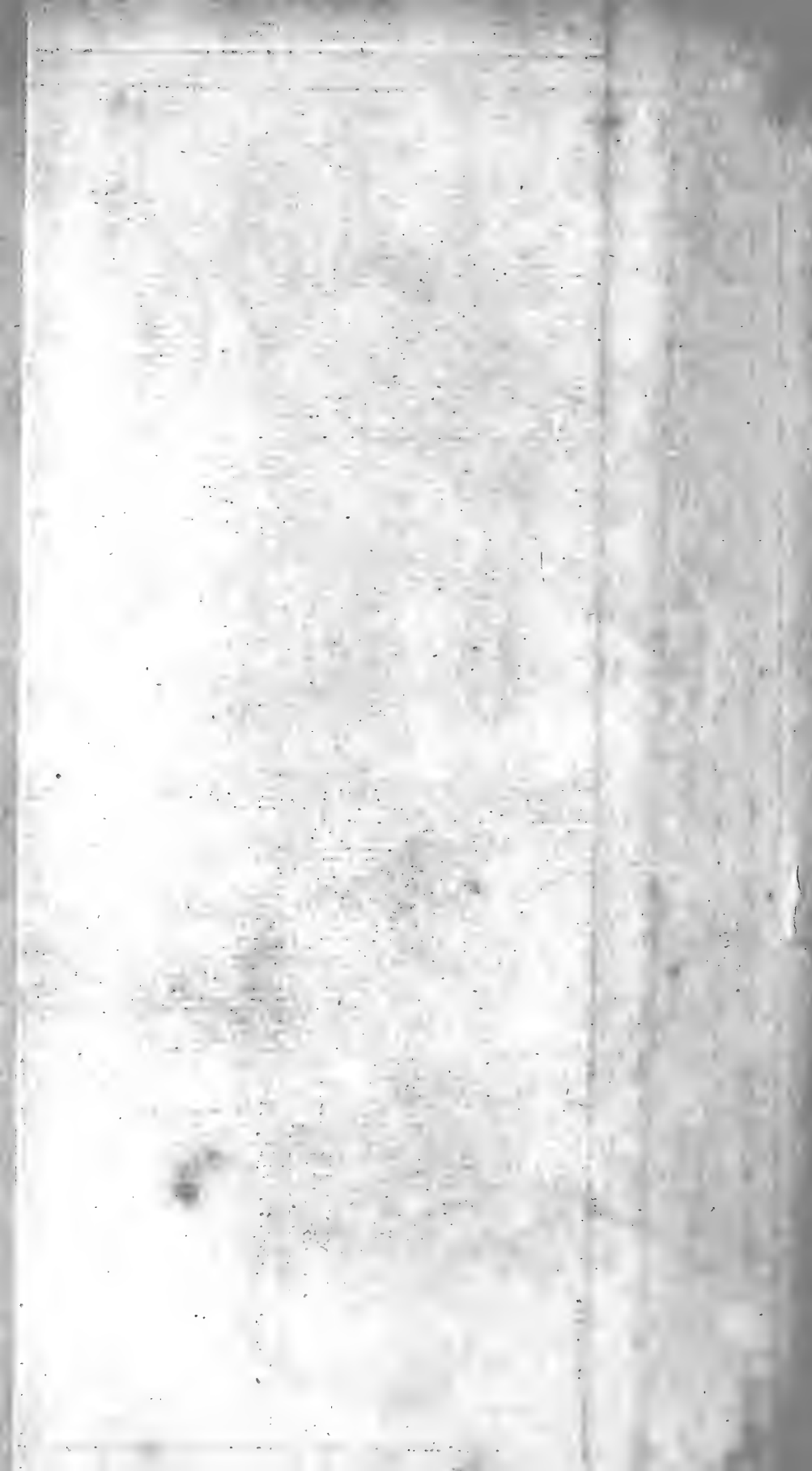






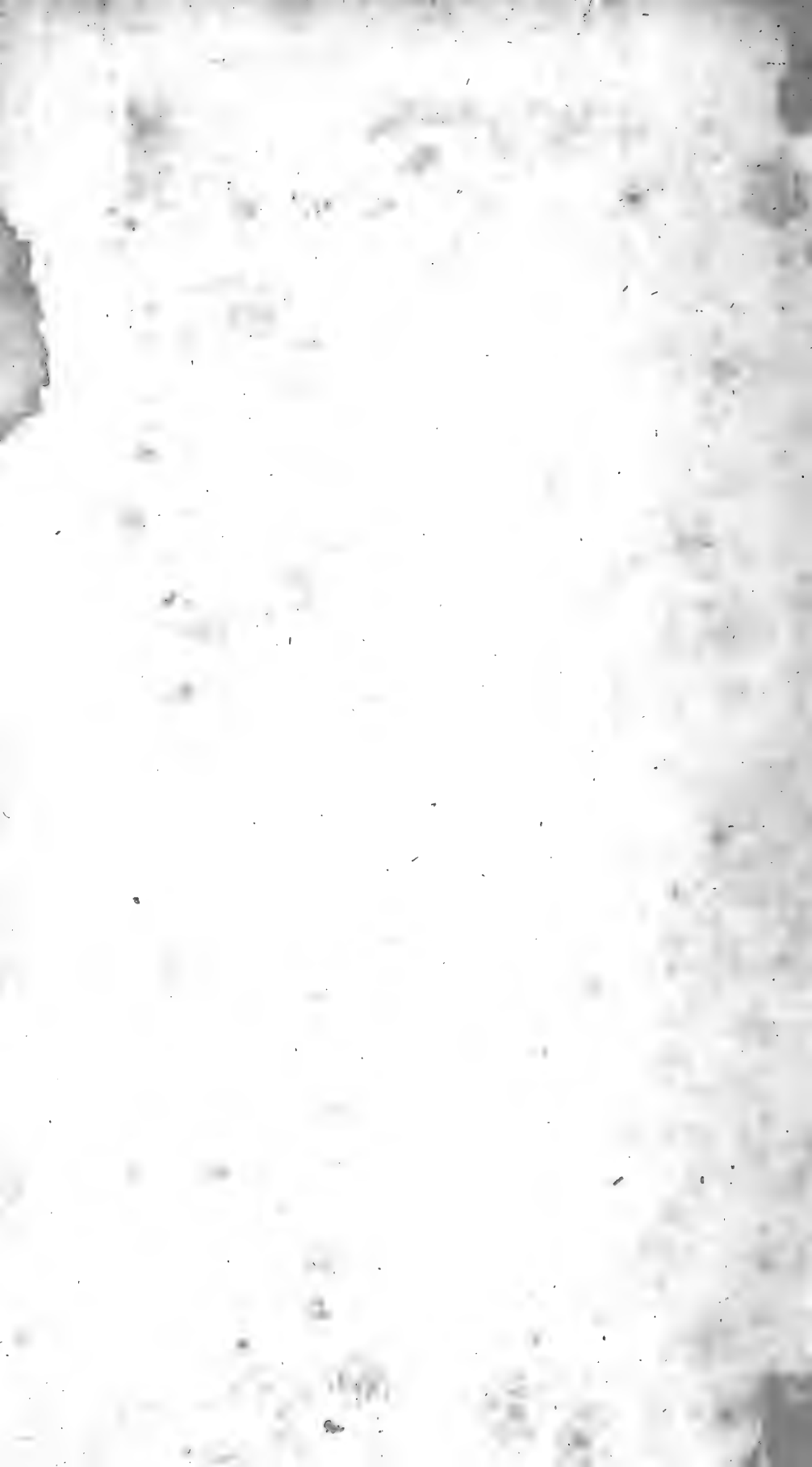


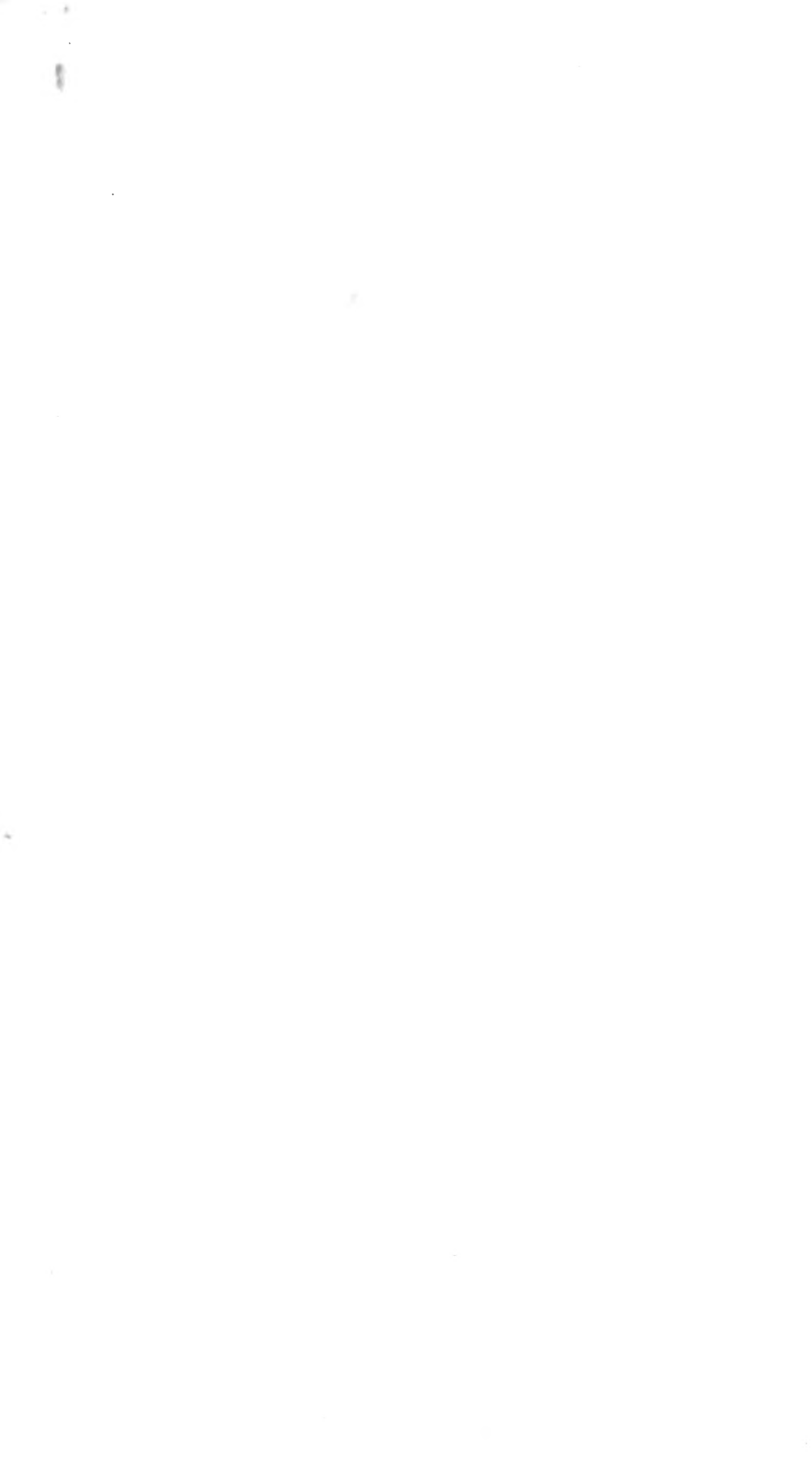


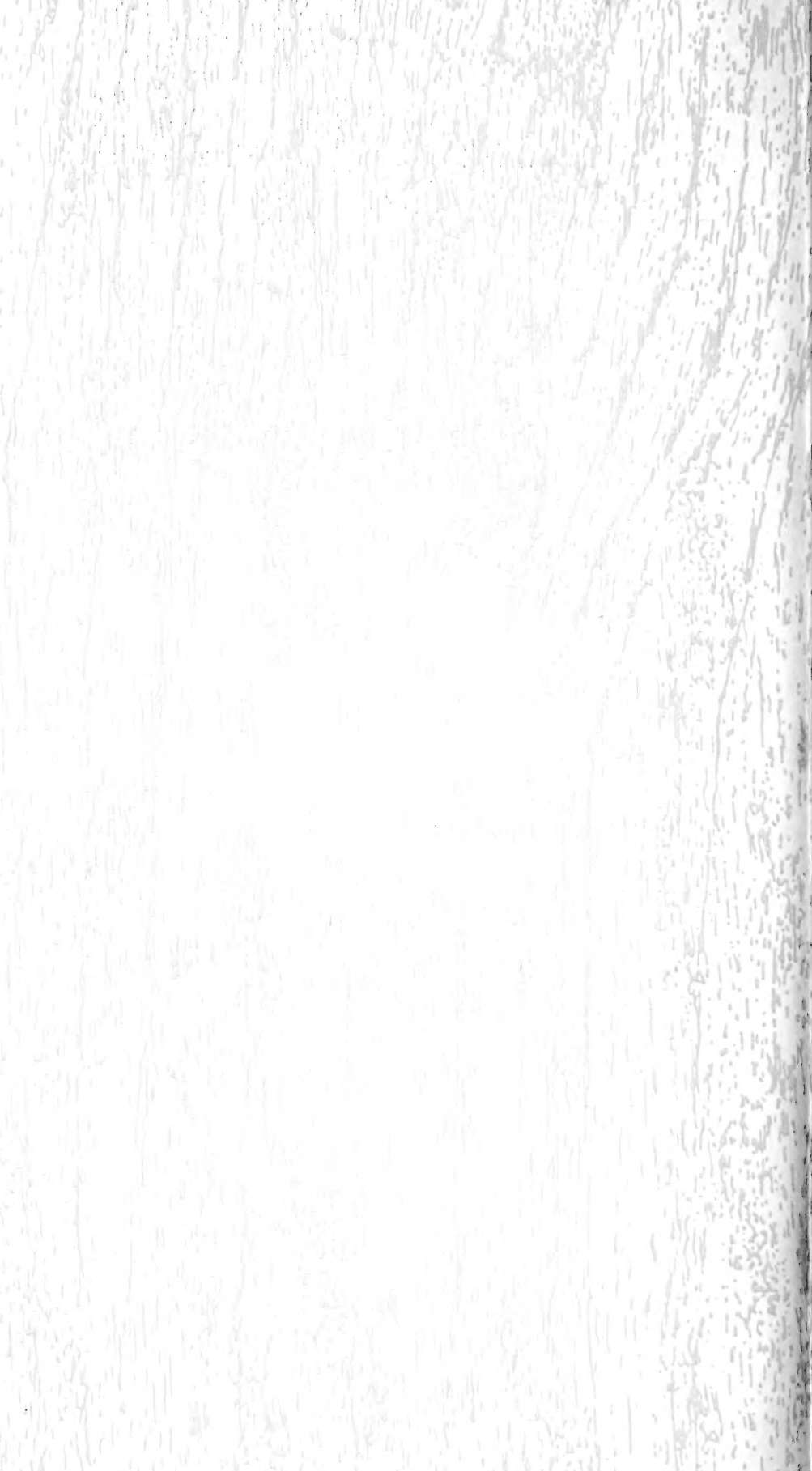


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